NOVEMBER 1953

Editorial

WHAT has happened to Australia's hopes for early television? About 12 months ago there was quite a bustle in political and trade circles centring round statements that the time was ripe to be up and doing. These were aired in Parliament, in newspaper interviews, in public controversies. The culmination was a Royal Commission to enquire into television in wide terms, and make recommendations about what should be done and how to do it.

There were sceptics who thought the Commission would achieve little and take far too long to do it. The Prime Minister assured us that he expected the Commission to have completed its work and report not later than about May of this year. Things looked set to go.

Well, they don't look set to go today. The Commission has heard its evidence and is preparing its report, but we haven't seen it yet, six months later than expected. We were assured that its activities were not to be a device for the Government shelving the whole thing for a later date. I don't know what a definition of shelving might be, but we are having a pretty good imitation of it.

To add an interesting sidelight, Mr. Calwell, whose opinions carry some weight in his party, has made it pretty clear that if he has anything to do with it, nothing the present Government has said or done about television will mean a thing if Labor wins the next election. Should the Government allow commercial participation in television, he will revoke it. Notwithstanding anything the Royal Commission will recommend, he will see that there is yet another one held with different terms of reference.

About a year ago I wrote that television stood in danger of becoming a well-kicked political football. In what other light can we regard it today? It is obvious that the present Government is unwilling to take any decisive step, and is unlikely to give the matter any serious thought until the Royal visit has come and gone. There is no chance now of anything being ready in time to catch this event with TV.

In the meantime, as expected, the march of time is having its impact on TV overseas. The emphasis is still on color, and is likely to be now that RCA has virtually persuaded all and sundry that its electronic and comoatible color system is the only one on the horizon likely to succeed.

So that when the wheel does turn again, and our blood pressure is amplified by promises and hopes, we will probably have a somewhat changed background on which to proceed. In the meantime, with elections looming up next year we should have about 18 months before it's worth getting excited. Maybe that inspired Mr. Calwell to courage in talking about his new Commision. By the time his chance comes round we may need it anyhow.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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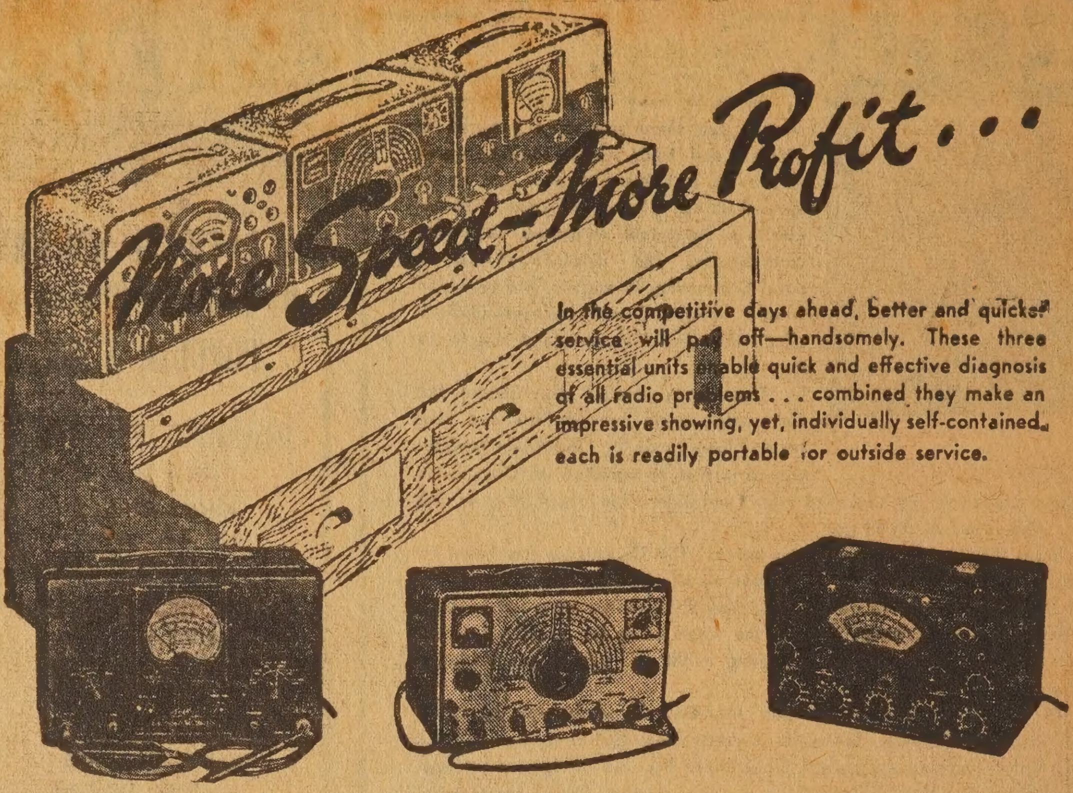
OUR COVER PICTURE

Emphasis was on television at the recent British Radio Exhibition at Earl's Court. The picture shows a massive 27-inch picture tube, largest on the market, which sells for about £25. A complete receiver using it costs about £250.



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Detachable co-axial leads, 20 page instruction book supplied. Employs 4 valves.

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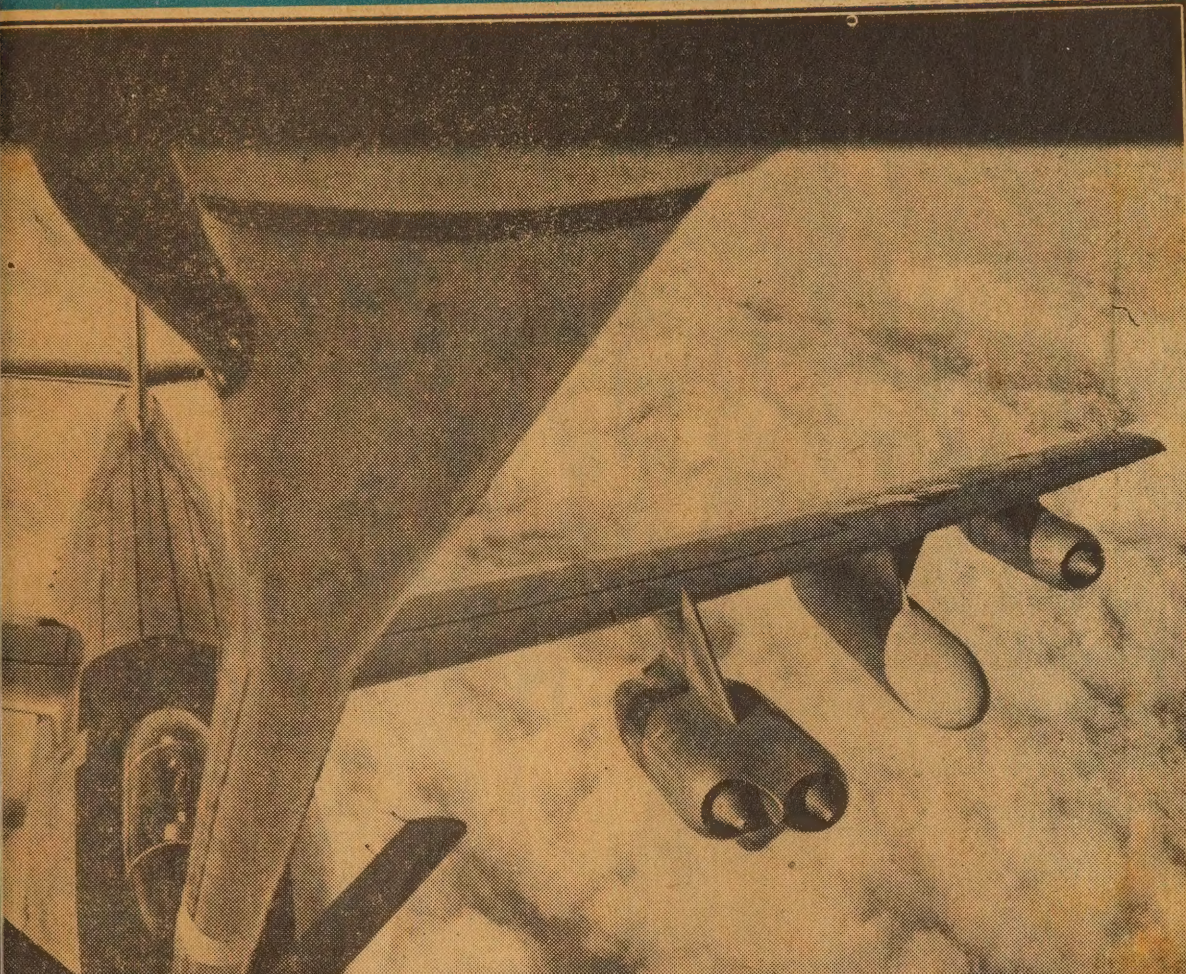


A Boeing B-47 Stratojet takes on a load of fuel from a KC-97 Stratofreighter tanker transport. Note V-shaped "ruddervators" which stabilise the telescopic flying boom.

FIRST PICTURE STORY SHOWING

This print, taken from a clip of "The Robe", shows how, in filming the image is laterally compressed so that the widened dimension can be accommodated in the standard size picture frame. In projection, a special anamorphic lens is used with the projector to provide the necessary widened display. The final picture appears on a curved screen which partially envelopes the audience. The film is in color, which unfortunately we cannot show.

Austalia is about to pass judgment on movieland's latest invention — The CinemaScope. From off the battlefield of the film studios to produce bigger and better pictures and revitalise the industry, many consider this to be the immediate answer. It is certainly a big step, involving not only screen presentation but the sound system as well.

As the safest way to guard against the material and social threat of television, movie-makers had to come up with something the TV stations couldn't reproduce, at least for a long time.

The rapid progress in TV color has only highlighted this need.

Mindful of the big issues at stake, and the possibility of wrecking rather than reviving pictures, the big studios have been extremely wary of 3D pictures, to which audience reaction is as yet uncertain. No studio has felt safe enough to throw all its eggs into the 3D basket. As a result, the films released so far have highlighted the novelty possibilities of the idea, and we have not yet seen how good 3D can be.

The studios are frightened to risk their all in a single, virile drive for 3D.

In contrast, widescreen pictures and augmented sound are comparatively safe ventures. Most people like a bigger picture and improvements in sound are in any case overdue. CinemaScope is the first large-scale attempt to capitalise on both these things. If it succeeds, it may well point the way for the next era in pictures and 3D, regarded by many as inevitable, may have to wait.

The wide, curved screen of the CinemaScope is claimed to give a degree of 3D illusion which, it is hoped, will be good enough. If this is true, we may not see the 3D problem arising again for a long time.

The most important of the CinemaScope efforts seems to be The Robe, and the 20th Century-Fox studios have not stinted its maiden effort.

In contrast to the 3D pictures we have seen, much time and money has been spent over it. A big cast of top-line actors was gathered together and, of course, the picture is in color. Color seems a "must" in such a venture, and the new process may mean the end of black and white for major pictures.

At any rate, we will see CinemaScope as fully expanded project, in which film technicians and sound engineers alike have made big contributions.

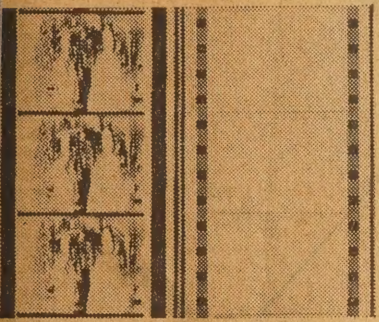
NEW CINEMASCOPE PROJECTOR

In this article, we are able to give tails of the essential new features hind the CinemaScope screen.

Pictorially, the new process is dif- ent from the wide-screen or Pan- amic presentation already installed some Australian theatres. This ethod in general uses the same pe of picture as employed to date, it gives a wide aspect ratio by mming the top and bottom of the age. Its main fault lies in the aggerated "close-up" effect which, times, gives monstrous proportions the actors. It greatly widens our int of view, but otherwise gives tle that is new.

The CinemaScope, on the other nd, achieves its wide aspect ratio compressing the picture during e filming, and restoring it to nor- al in the screening.

The picture shown here was inted from a section of film taken om The Robe, and although the lor is lost in the process, the teral compression is clearly seen. The effect is similar to that ob-



Two contact prints from the film strip. At the right the print is light to show the sprocket holes, and at the left it is denser to reveal the picture. The four sound tracks, similar to those of magnetic tape, show up as white lines on each side of the sprocket holes.

rved in a fun-parlor fitted with distortion mirror. The curved rface of such a mirror distorts our image so that you appear as spindly person about 10ft high stead of as you really are.

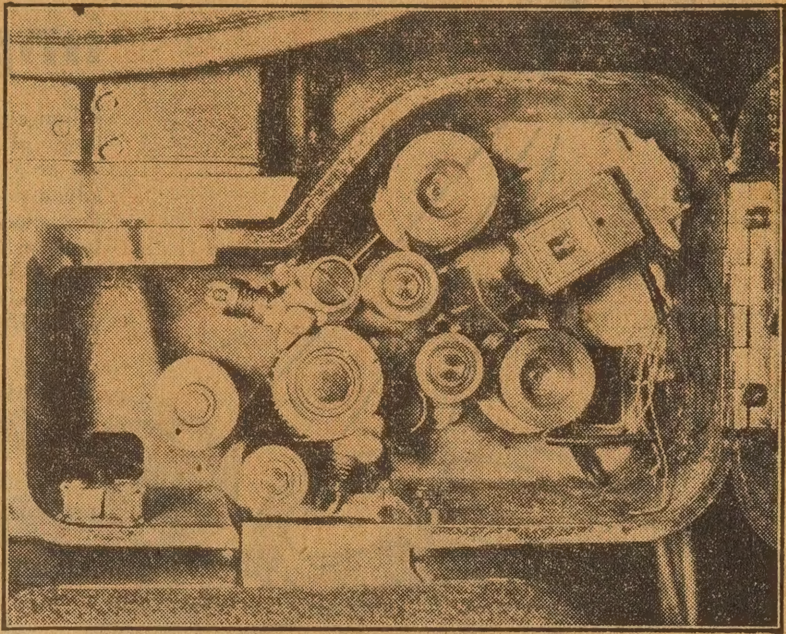
If you tilt the page away from u and look at the picture ob- quely, it will resume somewhat its ormal state, and give an idea of w it will appear when projected a wide screen.

In addition to being wide, the reen is curved, so that it appears partially surround the audience. his, it is claimed, gives a degree intimacy not possible with a flat cture. Naturally, alterations must made to the theatre, and to the ojector, so that these effects will obtained. An advantage of the stem, it is claimed, is that stan- rd projectors can be modified in ch a way that they will still be le to show standard films.

With the entrance of the wide reen, single-point sound for pro- ction must go out, otherwise an tor speaking from one side of the screen will be heard with his voice apparently originating from a spot many feet away. The difference is too great for adjustment by the ear.

The obvious answer is to provide more than one source of sound reproduced through separate channels and speaker systems arrayed behind the screen.

The standard film allows for only one sound track running at the side of the picture to ensure synchronism, and although this could possibly be expanded to two tracks,



A close-up of the "Penthouse"—the new, single film system with magnetic sound heads. Compare this with the diagram below.

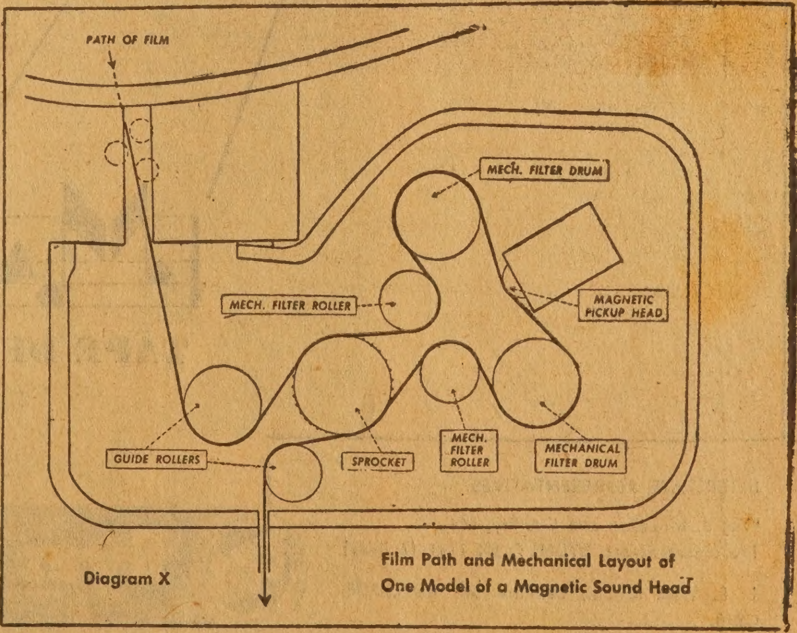


Diagram X

Film Path and Mechanical Layout of One Model of a Magnetic Sound Head

This digaram shows how the film is threaded through the "Penthouse" which ensures an even speed across the quadruple recording head which reproduces the recorded sound on the magnetic tracks. There is currently some apprehension about wear on the magnetic heads. Experimental results are not available but engineers tip that City theatres may have to replace the heads every few weeks.

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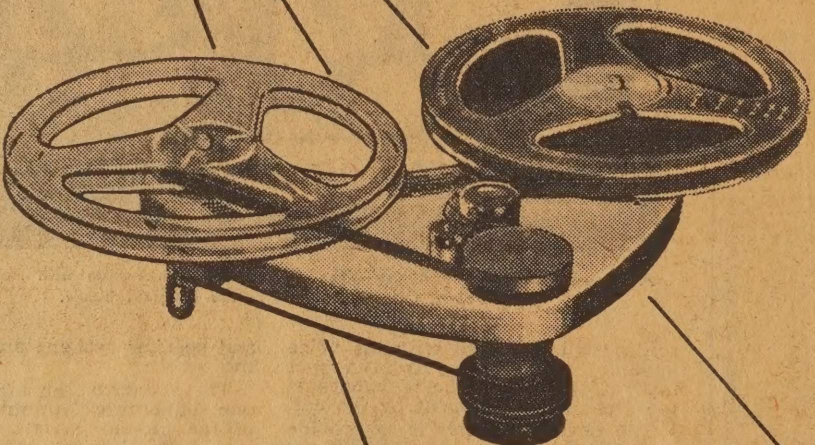
When an experienced audio engineer looks at "BRS" equipment, he can see at a glance that there are many advanced features which make for first class reproduction. But after long usage he will know that the "BRS" symbol is equally notable for trouble-free operation and utmost reliability.



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ıore than this are required to gain ıll advantage from the wide screen.

One solution has been to record ıe sound on a separate strip, and ɔ run it through reproducing heads ɔcked in with the projector. There re obvious disadvantages and inonveniences with this method, vhich cannot compare with the simlicity of having both sight and ound recorded together.

In CinemaScope, engineers have olved the problem by using magetic recording instead of the varible light strip and photo-electric ell. It has been found possible to dd four oxide-coated strips on the lm each side of the twin sprocket oles, after the manner of magnetic ape, but using the film stock in lace of the normal plastic base. Three of these strips are used for ound channels, and the fourth for ffects and/or various control signals.

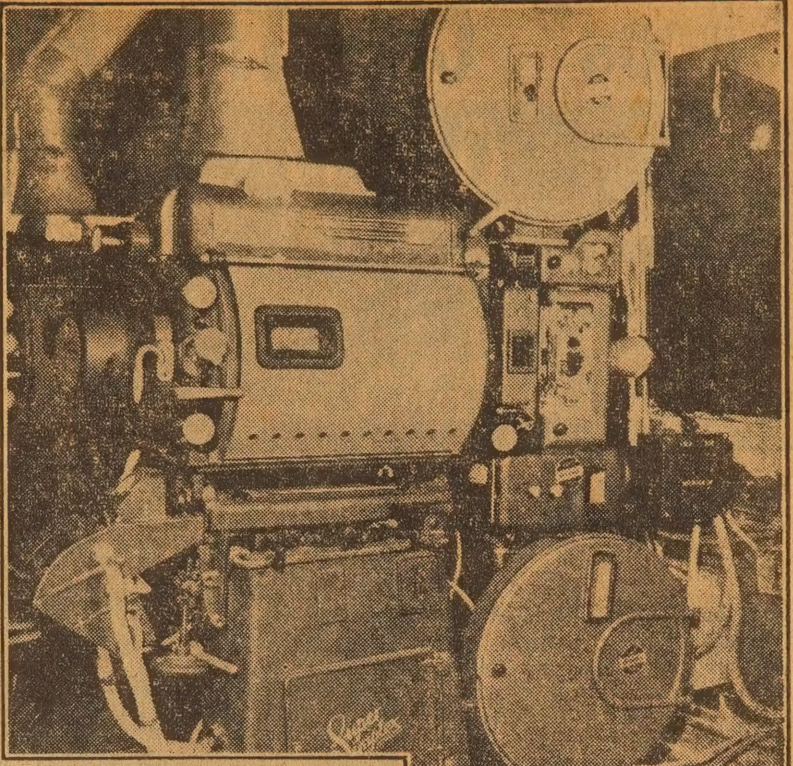
Thus at one stroke the single film trip has been preserved, and comlete synchronism achieved, as there s virtually no shrinkage or stretchng with the film stock as there is iable to be with standard magnetic ape.

We show here a print from the lm itself, printed lightly at the ight to show the sprocket holes, nd more densely at the left so hat the picture shows through. As his is a negative print, the sound racks appear as white lines, two wide ones each side of the left-hand sprocket holes, and a narrow and wide line each side of the right-hand sprocket holes. The narrow line of the four is the control track.

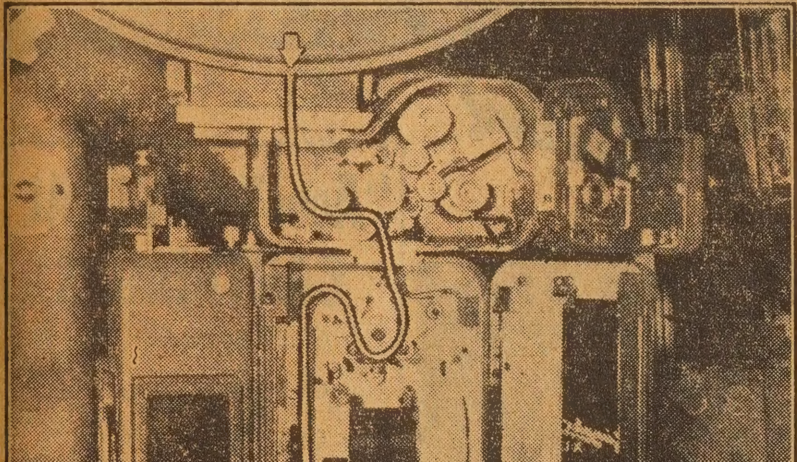
To accommodate all these tracks, the sprocket holes have been trimmed from the present standard of .110 to .078 inches.

Changes required in the projector are a slight reduction in the width of the teeth of the intermittent and other sprockets, together with a correction of the centre-line spacing of the teeth and the addition of a simple, multiple, film driven sound head installed between the upper magazine and the regular projection head. The new sprockets will carry all types of film.

(Continued on Page 41)



This photo shows how the "Penthouse" sound head is installed between the upper magazine and regular projection head of the standard 35-millimetre projector. The nagnetic sound head becomes a permanent installation and permits the showing of any kind of picture—2-D, 3-D or wide-screen, stereophonic or ordinary. The CinemaScope anamorphic lens can be seen on the front of the machine.



For showing pictures using optical sound tracks, the projectionist utilises only the guide rollers in the "Penthouse". He then continues through the regular picture gate mechanism and optical sound track pick-up system. This pictut shows the path of the film.

"Acos" CRYSTAL PICK-UPS . . .

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It is new in pick-up design, has 20 times greate output than comparable magnetic types, and aute matic bass response while needle talk and mote rumble are practically non-existent.

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The Acos Model HGP.34 Turnover Type Pick-up is fitted with the new and radically different HGP33 crystal cartridge. Output nominally 1 volt on standard records and ½ volt on L.P. records. The response characteristic is smooth with no resonance. (Data sheet gladly forwarded on request.)

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Incorporating the GP29 Cartridge
STANDARD-LONG PLAYING

PRICE £4/17/6
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The Acos GP.30 turnover head type pickup is fitted with two separate sapphire styli, one for standard and one for microgroove records, either of which can be placed into operating position by a simple turn of a knob at the front end of the pick-up arm. The knob is clearly marked to show which stylus is ready for use.

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The HGP.33 crystal cartridge is a high compliance cartridge which is used in the Model HGP.34. The salient points of this cartridge are:—Extremely high compliance and low mass; Completely hermetically sealed crystal unit; Universal mounting.

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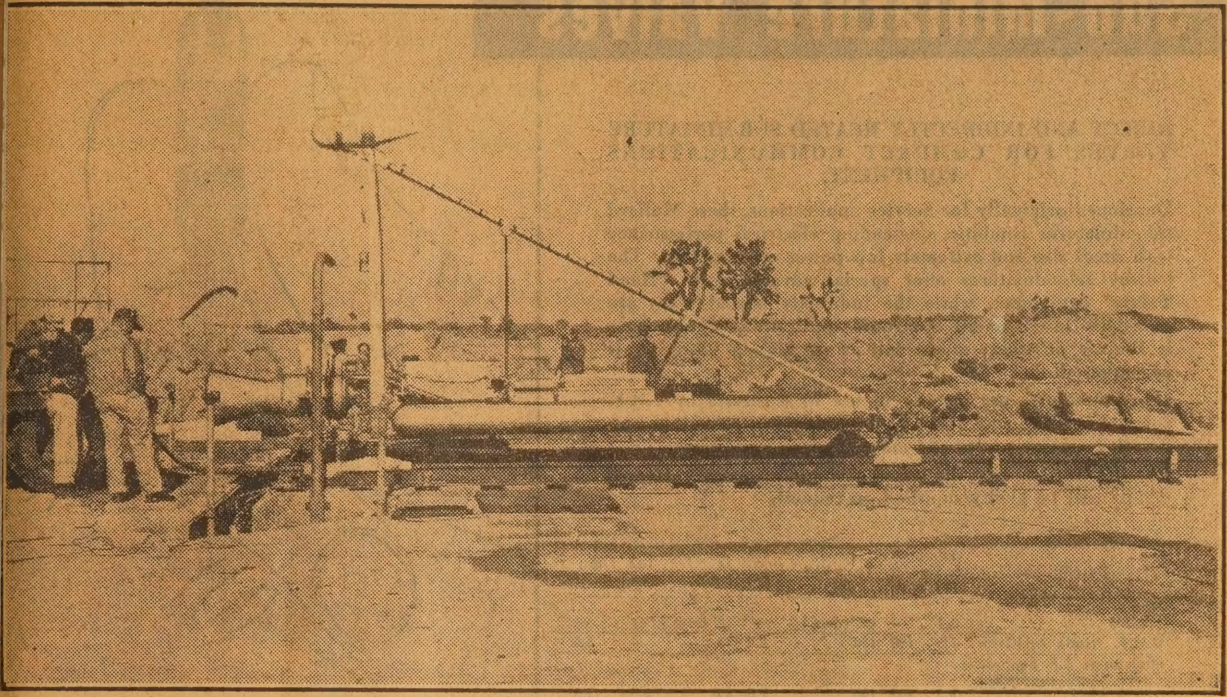

The sled is here seen on its rails at the launching site ready for its dash at twice the speed of sound. Rails are similar to train lines but more accurately laid.

A rocket engine to streak the world's fastest earth-bound test laboratory over rails at more than 1500 miles an hour has been designed and built for the American Air Force to test parachutes to be used with supersonic jet aircraft.

THE twice faster than sound laboratory, or "test sledge", was produced by the Cook Research Laboratories for the US Air Force's high speed test centre for aircraft and missile at Wright Field.

Using an oxygen-alcohol fuel to generate 50,000lb of thrust, the rocket engine can accelerate the sledge from dead stop to more than 1500 miles and hour in 4.5sec while travelling 5500ft. Although much smoother, track for the sledge is similar in type and size to standard 4ft 8½in railway line. Over 10,000ft of track is laid for sledge tests at Wright Field.

PARACHUTE TEST

Parachutes which operate satisfactorily when released during the high speed tests are certain to give good service when "bailed out" of jet aircraft at about half the speed of the sledge. Instruments and materials can also be checked for high speed service. With special adaptions, the sledge can be used to determine the effects of high speeds and fast stops on human beings.

The sledge's versatile propulsion system is readily adaptable to assist aircraft take-offs from runways or aircraft carriers.

The liquid fuel rocket engine has a distinct advantage over solid fuel types in its ability to operate over much wider temperature ranges in all kinds of weather. A test run using the liquid fuel power plant costs about £45 compared with £2500 cost for a similar test with a solid propellant unit. The rocket engine will run up to eight seconds with one fuelling and refuelling is almost as simple as refuelling a motor-car.

Mounted underneath the sledge is a scoop to act as a brake. The scoop is dipped in a water trough between the rails to bring the sledge to a stop in about 300ft.

The rocket speeds along the rails to test the parachute which has just opened.

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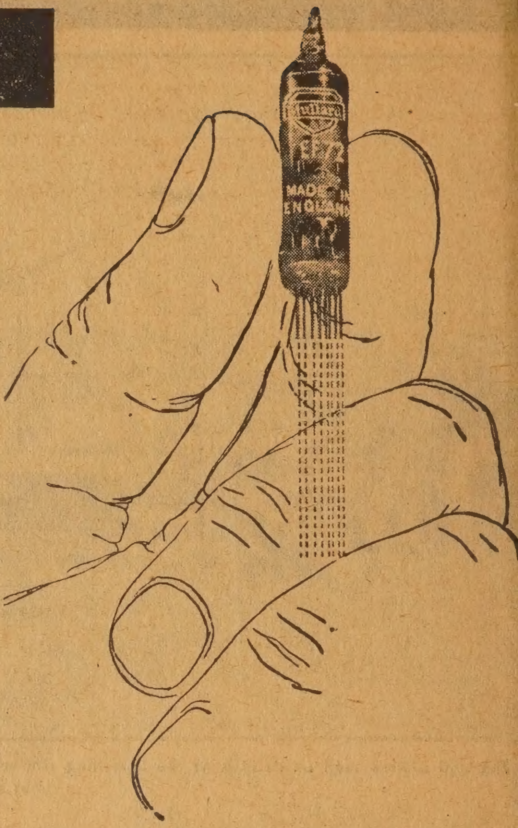
Developed originally for Service applications, these Mullard sub-miniatures combine outstanding electrical performance with small size and extremely low power consumption. The battery sub-miniatures offer special advantages in "Hand Talkie" equipment, while the indirectly heated types are especially suited to all electronic applications where space is limited or where shock impact or high *g* vibration is encountered.

Many thousands are already in use in Australia in V.H.F. communications and other vital equipment, providing outstanding service under the most rigorous conditions.

The illustrations give the actual size and complete technical details will be gladly supplied on request.

Type No.	Description	Filament or Heater (V)	(mA)	Va = Vg2 (V)	—Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)
EA76	Single diode (5 mm. bulb)	6.3	150	150 (max.)	—	9.0 (max.)	—	—
EC70	U.H.F. triode oscillator	6.3	150	100	2.0	13	—	5.5
EF70	High slope R.F. pentode with short suppressor grid base	6.3	200	100	2.0	3.0	2.5	2.5
EF71	Variable-mu R.F. pentode	6.3	150	100	1.2	7.2	2.2	4.5
EF72	High slope R.F. pentode	6.3	150	100	1.4	7.0	2.2	5.0
EF73	High slope pentode for industrial applications	6.3	200	100	2.0	7.5	2.5	5.25
EY70	Half-wave rectifier ..	6.3	450	250 (max.)	—	45 (max.)	—	—
DY70	High voltage rectifier (directly heated) ..	1.25	140	10KV (P.I.V.)	—	2.0 (max.)	—	—
DAF70	A.F. pentode combined with single diode ..	1.25	25	67.5	0	1.0	0.25	0.44
DF72	R.F. pentode with sharp cut-off	1.25	25	67.5	0	1.7	0.5	1.0
DF73	Variable-mu R.F. pentode	1.25	25	67.5	0	1.7	0.5	0.8
DL70	R.F. output pentode ..	1.25	110	150 (Vg2 = 90V)	—7.5	6.5	1.4	1.5
DL75	Output pentode	1.25	25	90	—2.5	1.75	0.4	0.85



The sub-miniature silica-loaded polystyrene socket illustrated (with silver-plated contacts) receives the stubs formed by jig cropping the 1½" long flying leads, which, if preferred, can be wired directly into the equipment.

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MR6-5

A NEW ELECTRON MICROSCOPE

Electron microscopes are now widely used to obtain magnification much greater than is possible by conventional methods. Their cost and complexity has so far limited their use mainly to special laboratories. Newer developments however are producing cheaper and smaller machines more suited to general and industrial use.

ALTHOUGH the first one was in use in 1932 few people, even now, know much about electron microscopes. The first instrument was about as useful as a good magnifying glass, and four more years went by before it was comparable to the ordinary microscope.

But the men who believed in this new use of electrons had faith that heir invention would one day make possible the examination of things which could not be seen by even the best optical instruments.

That those men were right was proved in 1940 when the electron microscope was giving magnifications about 100 times greater than the optical instrument.

It was a famous optician who discovered that there was a theoretical imit to the amount of magnification hat optics could give.

THEORETICAL LIMIT

This man was Ernest Abbe, and t was his theory which set men on he hunt for something better.

The work that followed was in the best scientific tradition, for contributions to it were made by men in Germany, the United States, Belgium, France and Britain. Much of this esearch was based on the work of he 19th century scientist, Sir Wiliam Hamilton, who propounded an "Analogy of Dynamics and Optics".

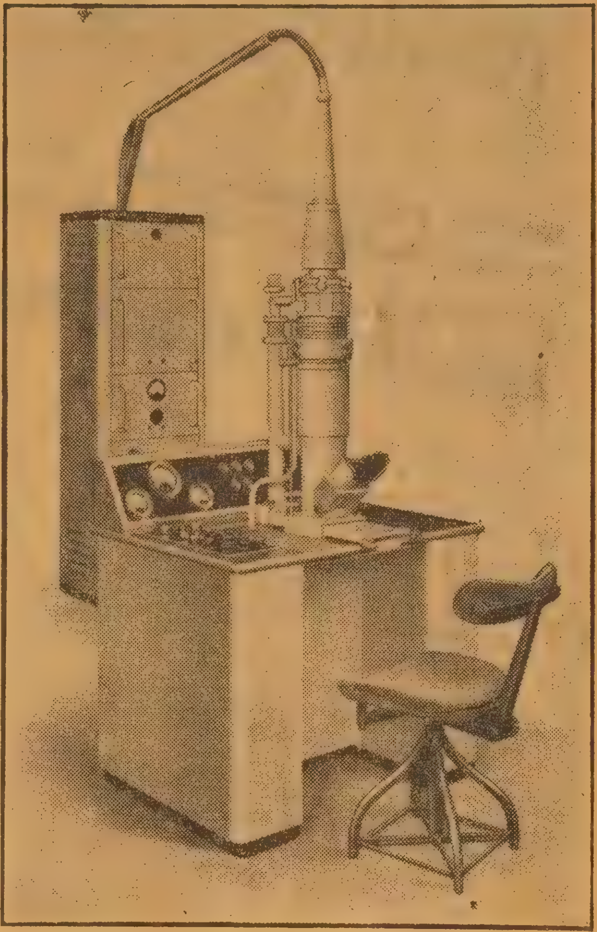
The first electron microscopes were actually built in Germany. They have now been developed in Britain, the United States, and Holland to somewhere near their ultimate limit for magnification, the reason for this being that there is nothing in nature mall enough to call for higher magnification.

HOW IT WORKS

The electron is becoming one of he most valuable servants of man. t even caters for his amusement hrough the television set, the heart of which is the cathode ray tube. The "blood" flowing through that heart is a stream of electrons.

The cathode tube is also the heart f the electron microscope. In fact, his type of microscope is chiefly athode ray tube, the rest of its equipment being accessory to the tube.

Electrons are part of every atom. Normally they stick very tightly to heir atomic nucleus, but they can be empted to leave it in the right conditions. Those conditions are provided in the cathode tube, and the electrons stream away from their nuclei in a narrow beam. This beam s focused on the specimen, but a good many are stopped by it. Those which get through light up the screen, and dark patches are left by those which did not. Thus a picture of the pecimen is built up. This is enormously magnified by magnetism before reaching the screen.



This electron microscope known as the E.M.3 has a magnification of between 3000 and 100,000 times. It is typical of the layer machines made in various parts of the world.

Not only can the beam be made to pass through thin films of some substances: it can also be made to bounce at an angle from a more solid object through which it cannot pass. This is called diffraction. By means of it the surface structure of, for instance, metals can be examined.

by Leonard Rule

Another way of doing this is to take a plastic replica of the surface of the metal from which the crystal structure of the surface can be deducted with fair accuracy. Although there are difficulties in using the "bounce" method, it was thought to offer better possibilities.

When it was coupled with the "scanning" system used in television, in which the beam of electrons is made to move rapidly across the screen viewing a tiny part of the specimen at a time, the prospects seemed even better.

Now a new scanning electron microscope has been built at Cambridge University, in England, which seems to be a great improvement on earlier models. It uses a somewhat different method of magnifying the electron beam, but has produced some excellent micrographs of aluminium and mild steel. Some of these pictures have a magnification of 6000 times. Results so far obtained are very promising, and in later models the advantages of the new system will be even more pronounced.

STANDARD METHOD

In the meantime, electron microscopy has become a standard method of examing a number of objects very minutely. In the ordinary way instruments are built for a special purpose, but new types, now being produced, are meant to have more general application. For example there is the model E.M.4, produced by Metropolitan Vickers Electrical Company, Ltd., of Manchester, which is called a "routine" model. It is supplementary to the E.M.3 which has a magnification of between 3000

(Continued on Page 13)

MAGRATHS' *Monthly* BULLETIN

NOV., 1953

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IS LIGHT SPEED CONSTANT?

Engineer times beam at 202,000 miles per second

A YOUNG electrical engineer recently clocked a moving spot of light at a speed substantially higher than light is expected to travel.

He caught his fantastically fast wink of light on a cathode ray tube—a cousin of the television picture—with a gadget called a time microscope.

Harold J. Peake, a graduate of Virginia Tech., USA, did the job at the naval research laboratory in Washington, where he is employed as a research engineer. The speed he measured was only a shade under 202,000 miles per second.

CALLED ABSOLUTE BY EINSTEIN

The speed of light is generally accepted as 186,000 miles per second. And one point in Professor Albert Einstein's theory of relativity is that this speed is absolute.

Light, says Dr. Einstein, travels at this constant speed without any relation to any other object in the universe. And it doesn't even have to accelerate. It starts off at 186,000 miles per second.

Peake's speed was merely a trace velocity caught by the time microscope and photographed as it pulsed across the cathode ray tube. This faster-than-normal wink of light was the speediest ever recorded so far as the navy knows.

What gave the light its big push?

Peake explained that the trace velocity on the tube changes in proportion to the swift shift of voltage.

NO PARTICLES INVOLVED

He got his 202,000 miles per second by applying signal changes at the rate of 3-million volts in a millionth of a second.

The engineer added that no particles of matter were involved and he didn't think the results were at odds with Dr. Einstein's theories. He said, too, that the trace velocity could be more properly called a phase velocity which has no theoretical or practical limits.

The instrument that caught the spot of light jumping quicker than light and photographed it as mechanically alert enough to catch events that occur in a fractional part of a millionth of a second—probably a millionth of a millionth.

Peake thinks the time microscope will be of considerable help in the study of electronics, electricity and the newer field of nucleonics.

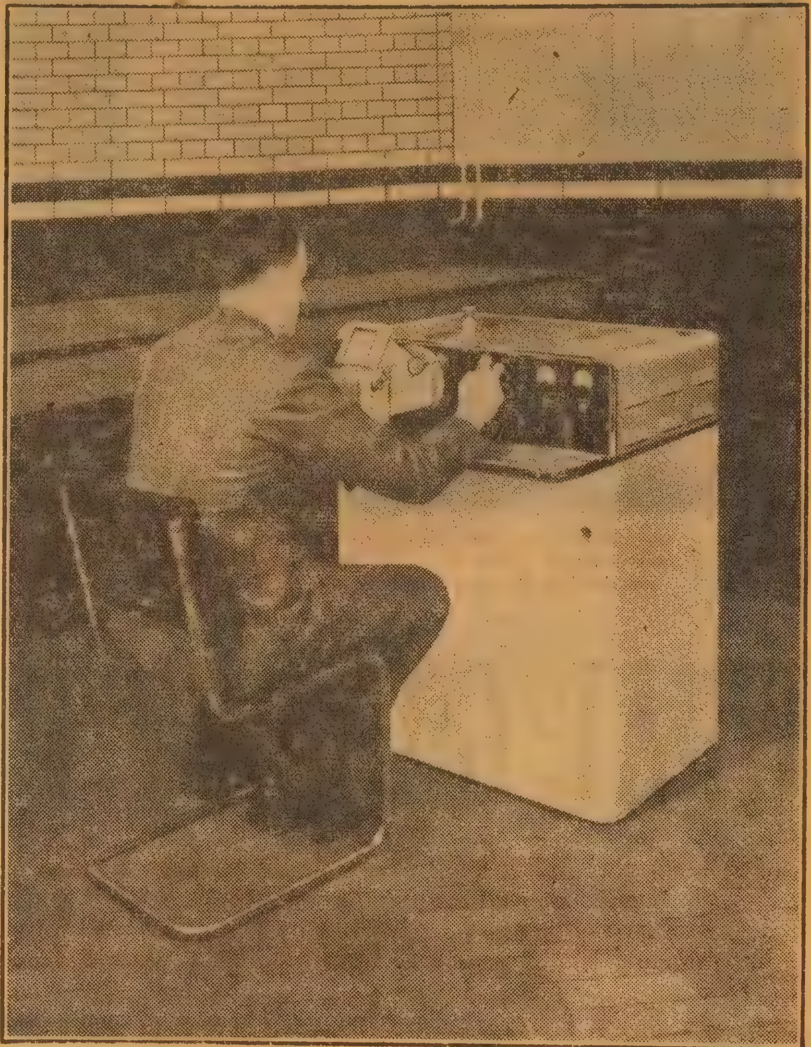
Fishing by sound

A NEW underwater sound "searchlight" gave the British whale-catching fleet a big advantage when the season opened recently in the Antarctic.

Developed by a British firm, a streamlined dome sinks below the hull of a ship and soundbeams sweep around like a searchlight.

It picks up a whale at 2000 yards and holds it until the ship gets close.

A NEW ELECTRON MICROSCOPE



One of the latest electron microscopes is this type E.M.4, a product of Metropolitan Vickers. Its performance although not as good as the larger types, is still adequate for many purposes, and it costs a great deal less.

(Continued from Page 11)

and 100,000 times, but costs more than £4000.

The new model magnifies from 1500 to 10,000 times and costs about half the price of the larger type. Already one of these new instruments is in use at Cambridge University.

Although it is unlikely that future developments of electron microscopes will give very much higher magnifications than the 200,000 which can now be achieved, there is a large field for development in the uses to which they can be put. The Cambridge experiments show the way for the study of metals, but much can be done to increase the uses of these instruments in medicine in particular. In physics, too, the power of electron microscopes will be of immense value, especially in nucleonics.

This micrograph of magnesium oxide, taken with a Philips microscope, shows the cube-shaped crystals of magnesium oxide on a Formvar film, shadowed by a stream of uranium vapor. Magnification is 18,000 times.

It is no longer sufficient merely to understand cloud formations and wind currents. Rocket research and the vision of future space travel demand a knowledge of conditions in the very fringe of the earth's atmosphere.

WHAT GOES ON UP THERE?

For ages past it has been man's desire to climb as high into the upper atmosphere as his physical resources permitted. At first this desire had for its motive merely an urge to climb higher than any one else. The adventure, for that was all it was, could be likened to that of a mountaineer who looked at a frozen mountain peak and immediately decided to get there.

by Calvin Walters

THE result, from a scientific point of view, did not contribute so much at first to the welfare of man as much as it demonstrated man's determination to conquer nature.

This indomitable spirit in man still impels him to reach out into the nethermost recesses of the universe. Some do it merely from a spirit of adventure, some from a desire to discover the secrets of our existence.

The upper atmosphere is something which the average person takes for granted. It is the source of his oxygen supply. It is the source of his weather, with its temperatures, humidity, wind and rain.

NEVER SUITS

He praises it today, but curses it tomorrow, if it interferes with his comfort and well-being. In fact, the atmosphere suffers a great variety of praises and imprecations all at the same time. It never suits all the people at the same time.

The atmosphere is really a vast storehouse of knowledge, which is waiting to be won. It contains within it the answers to the secrets of the atom, of even the earth itself, and, doubtless also, the origin of life and the universe.

The great impetus to investigation of the upper atmosphere was given by the invention of the balloon in the year 1783. Flights in these were made as high as 23,000 feet in 1804. These were not mere jaunts at that time, but true scientific journeys to measure temperature and terrestrial magnetism.

From that time on, with the later development of the aeroplane, to the present time, with the development of high altitude rockets, great progress has been made with new instruments and an enormous amount of knowedge has been gained about conditions in the upper atttmosphere.

Before the advent of high altitude rockets and "robot" balloons investigation of the upper atmosphere was carried out only by indirect methods. These methods involve investigation of sound wave propagation, meteors, aurorae, and radio wave propagation. They still provide valuable information regarding the composition and condition of the upper air.

As these indirect methods require the application of physical laws to the information obtained, and a considerable amount of deduction as to the conditions which produce the phenomena, it follows that the findings must be based largely on assumption. This can introduce serious errors.

It is therefore necessary that indirect observations be supplemented where possible by direct methods. For the same reason a combination of indirect mehods must be applied to regions which are not accessible to direct measurements. In such a case direct measurements are made to as great a height as possible, when indirect observations take over. The two combined lead to more accurate results.

In general, the investigation of the upper air takes the form of research into items like temperature, pressure, earth's magnetism, cosmic rays, biology, composition of the atmosphere, measurements in the ionosphere, aerial photography, and so on.

It is the purpose of this article to describe the various instruments used to achieve this purpose.

AIR PRESSURE

In measuring atmospheric pressure it is usual to use a barometer. Such an instrument is useful only at comparatively low altitudes, where there is sufficient pressure to actuate the air-evacuated capsule and its associated linkage.

It is a different story, however, at heights of 100,000 feet, where the air pressure is not sufficient to even bend the thin metal of the capsule.

For these regions electrical means must be used. These make use of two well known electrical laws, which state that (1) the electrical resistance of a wire varies with temperature and (2) the pressure of the atmosphere affects the temperature of a heated wire.

In the rocket, or whatever method is used to reach the upper air, fine platinum and tungsten wires are mounted and electrically heated. As the pressure influences the temperature, so this varies and in doing so the resistance of the wire varies also. This variation is recorded or radioed to the ground, where the information is readily deciphered according to known standards.

Another instrument, called a hypsometer, is often used in high altitude balloons. This instrument makes use of the fact that the boiling point of a liquid depends on the atmospheric pressure. The instrument boils some liquid in a flask and automatically measures the temperature of the steam coming from the boiling liquid. As the temperature of the steam at varying pressure is known beforehand, the information gained from the hypsometer can be readily interpreted.

The temperature changes are relayed from the balloon by radio and are derived in turn from the changes in the electrical resistance of the element in the device which measures the temperature of the steam in the balloon.

In balloons, temperature can be measured in direct fashion by means of correctly designed and well ventilated instruments, but in rockets it is quite another story, because the rocket, by its tremendous speeds through the air, generates great heat in the structure of the rocket itself.

HARD CALCULATIONS

Thus, in the case of rockets, the temperature data is obtained by very complicated calculations correlated with additional data during the flight of the rocket.

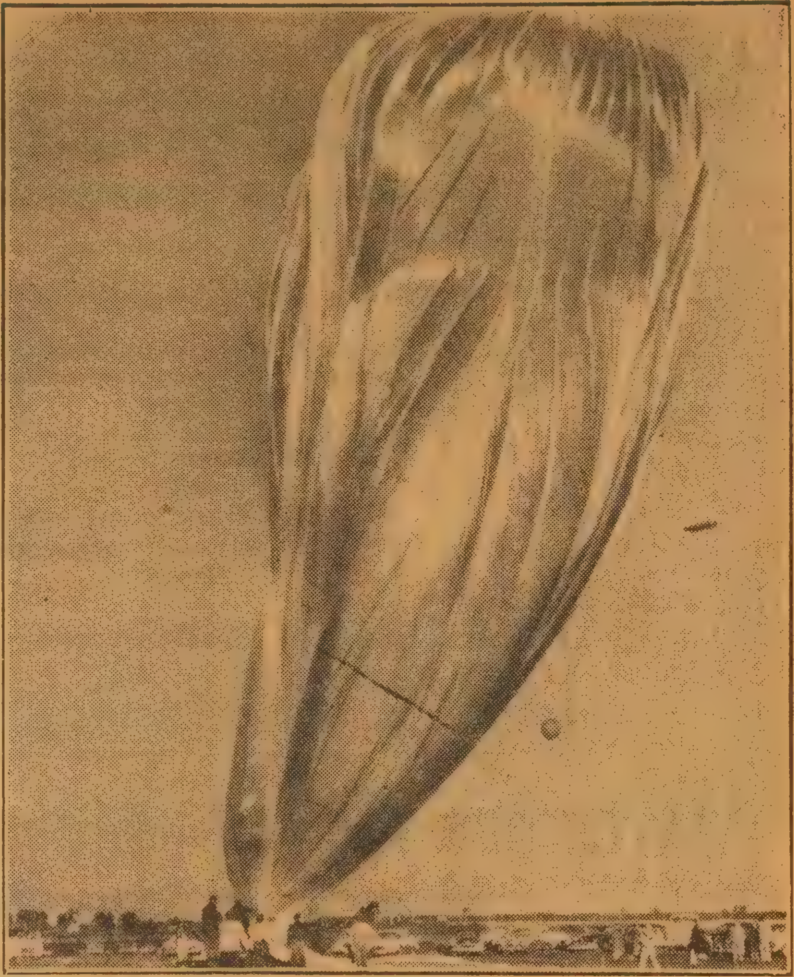
To measure the variation of the earth's magnetic field an instrument known as a magnetometer is used. This instrument is very often used in oil prospecting and for this purpose is towed behind an aeroplane.

The geological formations which are usually associated with deposits of oil cause changes in the earth's magnetic field which are registered on the magnetometer.

Shooting the magnetometer to great heights has proved that the earth's magnetic field decreases in intensity with altitude. It has also proved the existence of strong electrical currents, which flow from west to east at a height of 62 miles. This is considered to be a discovery of major importance, as it leads into further fields of very interesting investigation.

The composition of the upper air is analysed by means of an instrument known as a mass spectrometer. This is a device which electronically ionises the gases in a sample of air which it collects. Under the influence of a magnetic field, which is frequently and quickly reversed, the gas molecules are accelerated and deflected until they arrange themselves according to their weights. Thus, the gaseous components of the air can be identified and their amounts calculated.

One of the most important lines of research in the upper air is that of cosmic ray bombardment. For the past 50 years scientists have been fascinated by these strange rays which penetrate our atmosphere from outside.

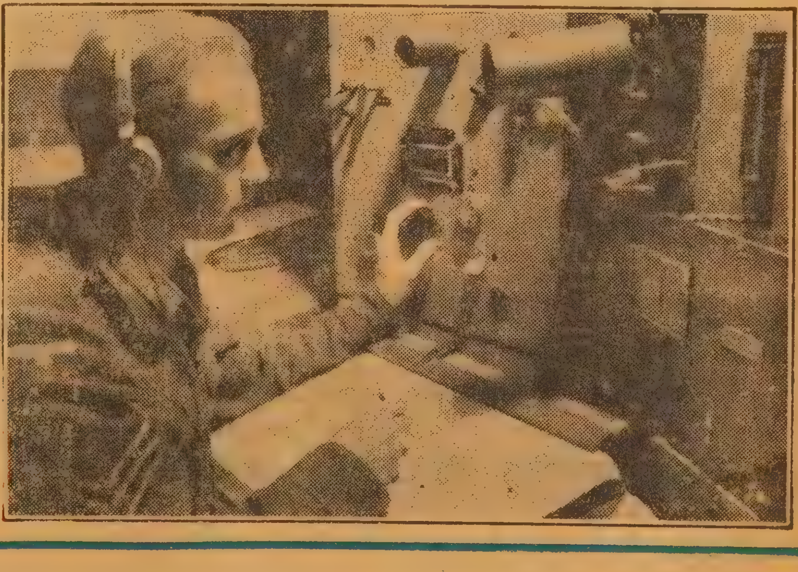


This huge bag of clear plastic, 287 feet long, was the first of the U.S. "Skyhooks". Built to carry cosmic ray research instruments 23 miles above ground, skyhooks have prompted many reports of flying saucers. They glow brightly in the sun's rays, long after it has "set" on the ground below.

While the origin of the rays is still a mystery, the nature of them is beginning to be understood.

A vast storehouse of information about atomic energy lies ready to be opened in cosmic ray research and it provides the scientist with a ready-made means of investigating the behavior of atoms.

The technology of the cosmic ray is very involved, but, generally speaking, primary rays rain down on the upper atmosphere with the speed of light from all directions. These



Information collected by research balloons is transmitted automatically by appropriately varied radio signals. These are received on the ground and de-coded into figures of temperature, pressure and a variety of other information.

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enter the atmosphere with energies of billions of electron volts. Without going into the meaning of that term, the energy released by the primary ray can be visualised when it is stated that the fission of uranium is measured in only millions of electron volts.

These primary rays are atomic nuclei and they collide with other atoms in the air, breaking them apart and liberating protons, neutrons and mesons. These in turn act like primary rays and break up more air atoms. And so the destructive process goes on, resulting in an enormous multiplication of particles, which reaches a maximum intensity at an altitude of some 50,000 feet.

RAY DETECTORS

Little wonder then that such a process captures the imagination of the scientist and that he wants to get as close to the phenomena as he possibly can.

Various instruments are used to detect cosmic rays, including the Geiger counter, the ionisation chamber, the cloud chamber and the photographic plate.

The Geiger counter is a gas-filled tube containing an electrode which runs lengthwise through the tube. The outer shell is the second electrode. No current flows through the tube normally but when a charged particle enters the tube a current will momentarily flow because it ionises the gas. Thus each time a charged particle of cosmic ray enters the tube a quick pulse of current will flow.

These small surges of current can be made to operate counters and other recording apparatus. In high altitude operations the pulsations are radioed to the ground, where they can be counted while the rocket is in flight.

Single counters are not of much use in determining the direction from which a cosmic particle entered the tube. But if several counters are arranged in a line and so connected that they will register only when they are simultaneously energised the direction from which the particle came can be determined. Such an arrangement is known as a Geiger counter telescope.

CLOUD CHAMBERS

The trail of a cosmic particle may be photographed in what is known as a cloud chamber.

This instrument makes use of the fact that water vapor will condense out on dust and electrically charged air particles. The cloud chamber contains a mixture of water vapor, alcohol and argon gas. When a particle enters this it ionises the argon gas molecules, which then act as nuclei on which the water vapor condenses. Thus a trail of water vapor in the form of a cloud becomes visible along the trail of the particle and can be photographed.

Space will not permit of further details of instruments used in upper air research, but it is well to touch briefly on the vehicles which are used to transport them into the upper air.

Rockets, of course, are well known and have had a great deal of publicity. They are especially useful at extreme altitudes but have serious disadvantages because of their extreme speed, unsteadiness and heat generating properties.

At heights of up to 100,000 feet the balloon is the most reliable, especially in the field of cosmic ray research, because it is in these regions that the effects of cosmic rays are most evident.

The most famous of all balloon types is what is known as the "skyhook". This was made possible by the invention of the plastic material polyethylene. This is a remarkable material, tough, light, a good gas container and stands temperatures from minus 40 degrees F to 120 degrees F.

The balloon is 72 feet in diameter and 120 feet high and weighs 115 lb. It has an inflated volume of 226,500 cubic feet. It can carry a load of 300 lb to a height of 100,000 feet and can stay aloft for from eight to 24 hours.

The balloon is laid on the ground in an uninflated condition. To it are attached with nylon threads the various scientific devices such as a timer to open the balloon and release a parachute to bring the load to earth, a parachute to bring scientific equipment to earth for later recovery, a radiosonde unit to radio temperature, humidity and pressure, a radio beacon for a "target" from a radio direction finder. If radar equipment is to be used for tracking the balloon an aluminium foil radar reflector is attached to ensure good radar return signals.

The balloon is inflated with helium but only partially, as allowance must be made for expansion of the gas by solar radiation and reduction in atmospheric pressure.

DATA BY RADIO

As mentioned earlier, all the equipment is carried on nylon lines and released at predetermined intervals. Some of the instruments radio all the information required.

The possibility of using these balloons for a piloted flight is quite a feasible one. All the precautions to protect the pilot, such as pressurised gondola, &c., have been perfected, and it would appear that such a venture would have been carried out long ago were it not for the fact that sufficient information has not been gained about the effect of cosmic radiation on the human body.

These "skyhooks" have made outstanding contributions to high altitude research and it has been established that many of the "flying saucers" seen in the sky in America have been "skyhooks" which have been released in large numbers without very much publicity over the past few years.

Flying at heights of up to 100,000 feet, these translucent objects have hovered over cities in periods of calm plainly visible to the naked eye.

FISH CLICKS GEIGER COUNTER

An interesting exhibit at a recent exhibition in London was this fish, made radioactive by treatment with minute quantity of Cobalt 60. As the fish swims around the aquarium tank, radioactive particles from the fish's body trigger off pulses through the Geiger counter tubes in the tank and cause loud clicks to be heard through an amplifier and loudspeaker system.

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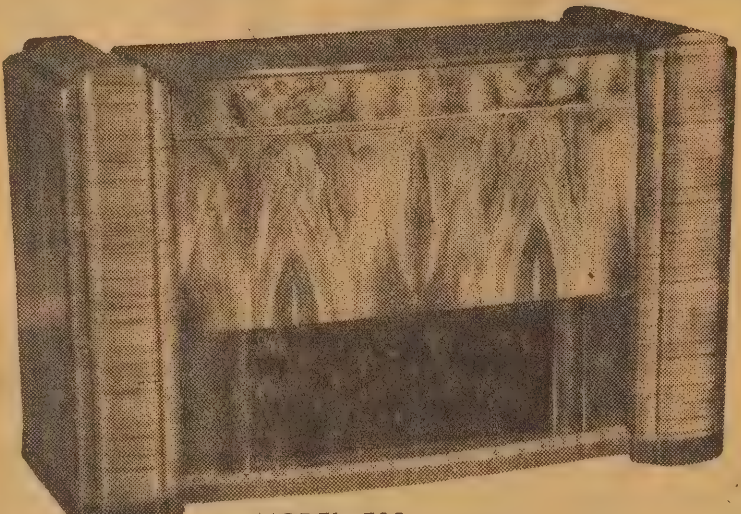

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Technical Review

HAZARDS WHEN RADIOACTIVE MATERIALS GET LOOSE

Much has been written about the precautions taken to protect personnel in laboratories from radio-active substances. But what happens when something goes wrong? As related in "Nucleonics", something did go wrong recently in the US Naval Radiological Defence Laboratory.

EVERYONE nearby was too busy to notice the slight crunch as someone in the student laboratory stepped on a glass capsule containing 40.3 mg. of radium sulphate. No one was any the wiser until 16 hours later, when a routine check by USNRDL personnel revealed widespread contamination of the building, and of students' hands, clothing and personal possessions.

Several task forces were immediately created to detect, control, and dispose of the contamination on the students and their property. The building was sealed, and no decontamination procedures were applied until the more urgent problem of contamination of the students was properly controlled.

A number of the students had microgram amounts of radium on the backs and palms of their hands.

INITIAL TREATMENT

Routine cleansing and scrubbing with soap and brushes was applied immediately after detection of the contamination, but the initial cleansing was only partially successful. Even the hair and legs of the students were radioactive.

Clothing and shoes worn by the students and by instructors were found to be contaminated. The soles of shoes, pockets and lapels commonly had alpha counts as high as 200,000 dpm.

Such personal property of the students as their automobiles and homes were heavily contaminated. In fact all surfaces normally touched by hands and feet were affected.

It was possible to trace (outline) the footsteps of some of the students into their homes and to follow their movements around the house. A divan was contaminated in the outline of the student's body, where he had lain down for a brief rest.

Table 1 gives the data from investigation of one home.

In automobiles, the flooring, foot pedals and steering wheel were most generally radioactive.

The students were monitored carefully upon arrival at the decontamination centre. All contaminated areas of the body were scrubbed with soap, water, and then citric acid.

Two days after the spill, a team from USNRDL undertook further decontamination. Alpha contamination was measured before and after each treatment. The treatment consisted of scrubbing with warm decontaminating solution for 2min, followed by rinsing. The treatment was repeated until no significant further reduction in contamination occurred.

The decontaminating solution was an isotonic neutral solution of a complexing agent, a detergent, and a germicide. The approximate composition of the decontaminating solution 3.0 pc of trisodium citrate, 0.4 pc commercial detergent, and 0.1 pc germicide. The solution was applied at pH7 at temperatures from 45 degrees to 50 degrees C.

Wool clothing could not be decontaminated satisfactorily where the contamination levels were high.

Cotton clothing and other washable fabrics were, in most cases, cleaned adequately by USNRDL standard laundry procedures.

TABLE 1 — Radium Contamination of Objects in the Home of One Student.

Object	Alpha Activity (dpm/85cm. sq.)
Door knob	1,500
Towel	3,000
Pillow	4,000
Water faucet	125
Bed spread	1,700
Carpet	2,300
Armchair	2,700
Writing desk	3,000
Slippers	275
Chair seat	4,000
Pencil	1,500
Shoes	20,000*
Clothes brush	1,500
Raincoat	4,500

* Measurements were made with a gas-flow proportional counting instrument.

Shoes were scrubbed with the skin decontaminating solution previously described. Repeated use of this solution gave uniformly successful results.

Floor mats, seat covers, and other similar permeable materials could not be satisfactorily decontaminated and, in most instances, they were discarded as radioactive waste. Hard surfaces, such as steering wheels, were cleaned by repeated use of the skin decontaminating solution.

Floors in the home were cleaned by the repeated use of surface abrading agents, detergents, and vacuum cleaning.

The first entry of the building itself was made three days after the spill occurred to determine the extent of the contamination and to locate the primary spill for possible recovery of the radium.

The survey group wore protective clothing including rubber boots, rubber gloves, cloth hoods, and rescue breathing apparatus (RBA's). The spill was located and marked, and measurements were made of the contamination levels of the air and the surfaces in the room.

Radioactivity as measured exceeded in some cases by over a thousand times the maximum permissible figure considered safe.

Rooms and areas in the building fell into four contaminated classifications. Twelve rooms, and the halls and stairs, were highly contaminated, eight rooms were moderately contaminated, six rooms were lightly contaminated, and five rooms were clean.

SPECIAL PROTECTION

During the initial phases of the building recovery operation, all personnel wore rescue breathing apparatus to insure protection from the inhalation hazard.

When the radon concentrations fell to safe levels and the radium values approached the maximum permissible concentration, personnel wore standard Navy respirators of the type approved for use against chemical agents.

The immediate objective of decontamination of the building was to remove as large a portion of the spilled radium as possible in the shortest time.

A dry method, vacuum cleaning, was used for the rapid removal of the loose contaminant to minimise further spreading.

(Continued on Page 111)

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DIELECTRIC HEATING CUTS WOODWORKING COSTS

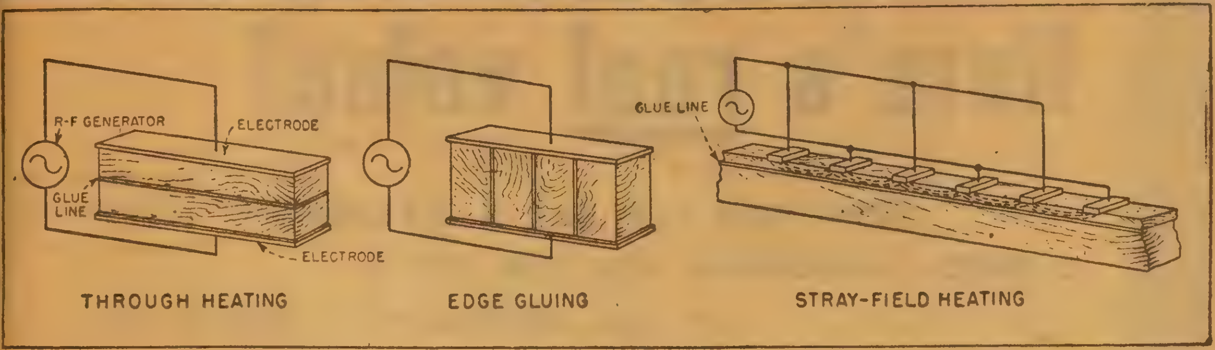

Fig. 1. Three basic production techniques employed in woodworking industry for electronic curing of glue lines.

An article in "Electronics" for June, 1953 tells how dielectric heating is being used in the woodworking industry to speed glueing and forming processes. Jobs which formerly took hours to complete are done in a few minutes.

ELECTRONIC wood-gluing is generally performed by one of three basic methods — through heating, edge-gluing or stray-field heating, as shown in Fig. 1.

The electrodes are parallel to the glue lines in through heating, this method being used where laminated sections are glued together to make plywood sheets or curved panels; it is also used in many assembly operations.

In edge-gluing the dielectric heater electrodes are perpendicular to the glue lines. This method is used for core stock and panel-gluing, veneer splicing and some assembly work.

Since the electrical conductivity of glue is greater than that of wood, the glue line absorbs most of the radio-frequency energy available.

Stray-field heating makes use of fringing fields between adjacent electrodes to cure glue lines accessible from only one end of the object. It is used to attach structural members to the inner and under sides of cabinet panels.

USE WITH VENEERS

One of the more recent unique applications is continuous edge-gluing of veneer stock ranging in thickness from 1/28in to ¼in. By dielectric heating, narrow selected clear stock, sliced or rotary cut, may be glued edge to edge, the stock flowing at right angles to the run of the grain and at a continuous speed up to 45ft per minute.

This device replaces methods of holding the veneers edge to edge with gummed tape or much slower methods of joining the wood edge to edge with glue set by contact with heated platens.

One of the earliest and outstanding uses of dielectric heating is the setting of glue in laminated sheets of plywood.

ELECTRIC HEATING

After the gluing and lay-up operation, several plywood sheets are stacked within a hydraulic press and heated electrically to 250F, as shown in Fig. 2. Glue setting is complete in less than 10 minutes for 24in stacks, after which finishing operations on the plywood can be immediately carried out.

This method contributes to in-line production and eliminates storage space and drying-room needs (10-15 hours for complete glue-setting) associated with the older oven-heating process.

The principles involved in the continuous electronic edge-gluing of veneers have also been applied with excellent success to lumber in continuous forward movement.

Electronic edge-bonding of narrow boards to form large panels and core stock is applied in the manufacture of desks, tables and other types of furniture.

One 5-kilowatt one-man edge-gluing panel-making unit operates at a frequency of approximately 5 mc and will glue panels up to 37in by 50in, with thickness from ½in to 2in. Production is continuous at the rate of a panel in less than a minute, with finishing operations following immediately.

FOR TV CABINETS

Probably one of the most competitive markets in the woodworking industry is that encountered in the manufacture of TV cabinets. Here the elimination of a few screws on each cabinet can represent thousands of dollars in annual savings, and RF heating has been able to do just that.

An air-operated press for gluing the several sides of a console TV cabinet together in one operation has eliminated driving screws or clamping for a prolonged glue cure period. This air-operated installation turns out 500 cabinets per 16-hour day.

In another case, rejects for repairs dropped from as high as 15 pc in humid weather with older gluing methods to ½ pc under the same conditions but with electronic glue-curing. Production loss due to high humidity and slow-drying is no longer a factor.

Massive sub assembly work is also being done with dielectric heating as a production tool. A plywood freight car, stronger and lighter than conventional cars, has been made possible by electronic curing of glued joints.

The Pressed Steel Car Company pre-assembles the boxcar sides, and

(Continued on Page 41)

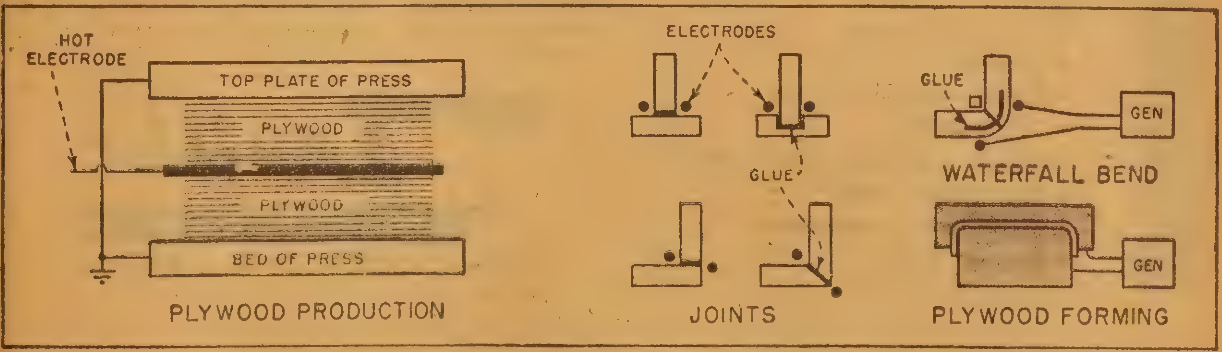

Fig. 2. Examples of electrode shapes and locations used for some of the commonest types of joints in wood materials.

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DIGGING COAL FROM HILLSIDE BY REMOTE CONTROL

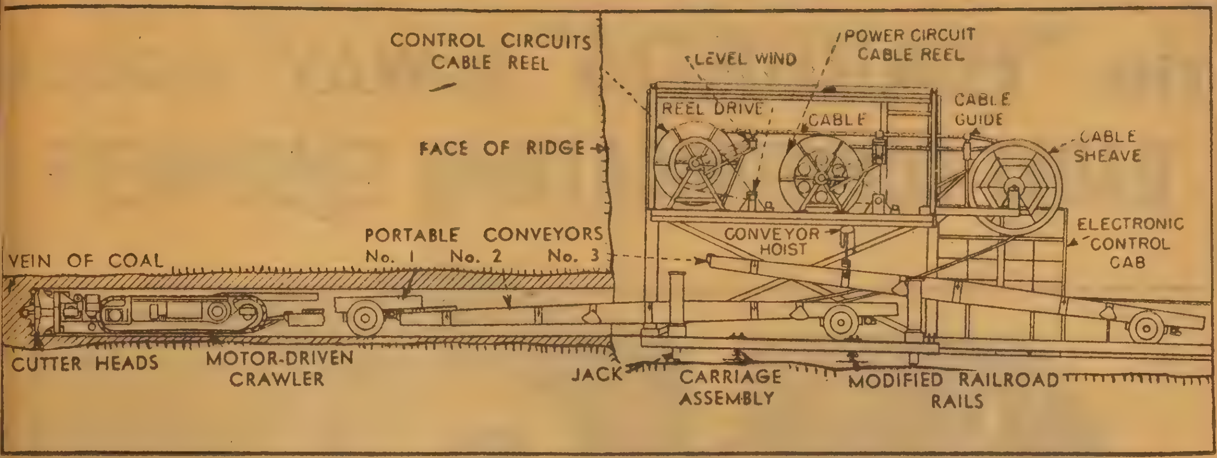

CONTROL CIRCUITS CABLE REEL
LEVEL WIND
POWER CIRCUIT CABLE REEL
REEL DRIVE
CABLE
CABLE GUIDE
CABLE SHEAVE
FACE OF RIDGE
CONVEYOR HOIST
ELECTRONIC CONTROL CAB
PORTABLE CONVEYORS
No. 1
No. 2
No. 3
VEIN OF COAL
CUTTER HEADS
MOTOR-DRIVEN CRAWLER
JACK
CARRIAGE ASSEMBLY
MODIFIED RAILROAD RAILS

Fig 1—Side view of the new mining machine, which runs on cross rails paralleling face of hill when moving to a new position for start of next tunnel. Crawler powered by electric motors supports rotating cutters that break up coal for conveyor feed out of tunnel to waiting trucks. 32 conveyor sections, added as needed, are towed by crawler as it advances into the vein.

Nobody goes underground. Instead an operator in control room outside the mine altogether watches two cathode-ray screens as the crawler-mounted cutter burrows into hill. Differential pickups on the cutter teeth generate signals proportional to hardness of strata in vein. Selsyns synchronise the rotation of cutters with polar presentations on twin scopes to give positional information.

THE Blue Creek, West Virginia, coal properties of Carbide and Carbon Chemicals Co. lie high up in scalloped ridges. The typical ridge has some soil on top, then 35ft or more of rock. Below this is the first of several lush coal seams.

Strip mining is out, because there's too much rock to remove. Deep mining is no better, because the ridges aren't big enough to justify it.

A new remotely-controlled machine was developed especially to do this mining job economically.

A horizontal shelf is bulldozed along the side of the ridge, roughly following the seam. On this, a track is laid to carry the machine.

The mining rig is a self-propelled double-deck structure, constructed as in Fig. 1. On the lower deck is the control room and a launching platform for the mining machine.

This deck is also provided with a conveyor that receives coal from the conveyor and feeds it to truck-loading equipment.

DRIVE MOTORS

The coal-cutter is mounted at the front of a crawler driven by a large variable-speed electric motor. Separate motors drive the four overlapping rotating cutting heads tipped with tungsten-carbide bits.

The coal in beween the four round holes made by the heads is broken out by bulldozer blades on top and bottom, to give a horizontal hole 116in wide and 38in high.

When the cutter has penetrated the seam to the length of one section of conveyor belt (about 30ft), a couple of minutes is spent hooking in another conveyor section. The cutter can then go another 30ft. Maximum depth of holes presently is 690ft. With additional conveyors, up to 1500ft of penetration is considered practicable.

When the hole has been mined to the desired distance, the cutter is withdrawn and the rig is rolled down the track to the next spot to be mined. Enough coal is left between drillings to hold up the top of the ridge.

The coal seams wander up and down in pronounced waves.

If the cutter is not guided, it will stray from the seam, either wasting its time in already mined territory, or ruining its cutter heads on the hard stone that sandwiches the coal layer.

To solve this problem, a sensing tooth is mounted on each of the outer cutting heads. These teeth project about an inch beyond the cutter and are spring loaded. The amount of deflection of a sensing tooth varies with the hardness of the various layers in, above and below the coal seam.

Rotation of the sensing tooth is synchronised with the travel of the electron-beam spot around the circle of the polar-co-ordinate oscilloscope in the control by the method shown in Fig. 2.

The output signal of the pickup is fed to the high-impedance signal input terminals of the oscilloscope through an impedance-matching transformer.

When a sensing tooth cuts through anything harder than coal, it deflects more and vibrates momentarily, causing the pickup output voltage to go up. This produces radial deflections or pips on one part of the circle on the screen. Movement of the pip in either direction on the circle normally means that the machine is going up or down.—"Electronics."

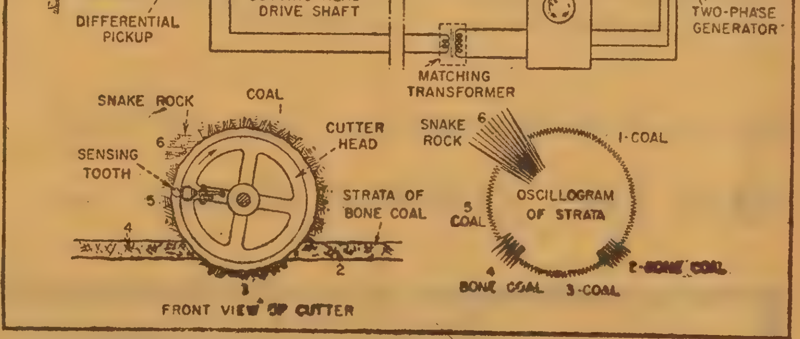
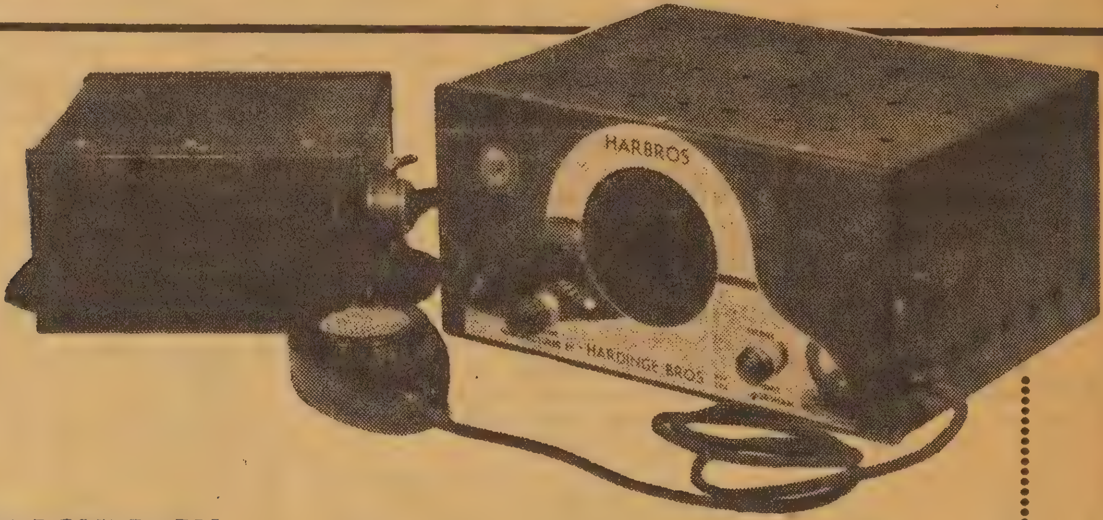

1,000-FT. 57-CONDUCTOR CABLE FOR CONTROL CIRCUITS
TO A-C POWER LINE
STRATA
SENSING TOOTH
CUTTING HEAD
SLIP RINGS
SELSYN TRANSMITTER
SELSYN RECEIVER
CATHODE-RAY POLAR-COORDINATE INDICATOR
CUTTING HEAD DRIVE SHAFT
DIFFERENTIAL PICKUP
TWO-PHASE GENERATOR
MATCHING TRANSFORMER
SNAKE ROCK
COAL
CUTTER HEAD
SENSING TOOTH
STRATA OF BONE COAL
6
5
4
3
2
1
FRONT VIEW OF CUTTER
SNAKE ROCK
6
1-COAL
5 COAL
OSCILLOGRAM OF STRATA
4 BONE COAL
3-COAL
2-BONE COAL

Fig. 2—Electronic control system for steering the cutter accurately, at a predetermined distance from roof or floor of wavy, wandering coal vein, for distances up to 1500 feet in from control station.

A Triumph of Australian Radio Engineering . . .

THE "HARBROS" 2-WAY MOBILE RADIO COMMUNICATIONS EQUIPMENT



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NEWS AND VIEWS OF THE MONTH

Huge meteorite

THE Woomera atom test would be like a firecracker compared with the explosion which must have accompanied a meteorite at Halls Creek (WA district), three scientists said recently.

They are W. A. Cassidy, Fulbright scholar: Dr. A. Dertz, a Fulbright lecturer and H. Gross, an Adelaide Museum biologist.

Mr. Cassidy, world expert on meteorites, came to Australia to investigate the world's second largest known meteorite crater at Halls Creek.

He said they made a topographical survey. It is a half mile wide, its estimated age about 1-million years.

He said they collected about half a ton of the original meteorite, which is being sent south for investigation.

Mr. Cassidy said the meteorite did not figure in the legends of the local aborigines. It must therefore be very ancient.

* * *

Cold surgery

A NEW French medical discovery —"freezing" patients into a long sleep after they have drunk a medical cocktail—has cut battle fatalities in Indo-China by more than one-third.

Some French experts believe that it may revolutionise surgical practice generally.

The discovery is called artificial hibernation. It has now become common medical practice in France for serious operations.

It is also used in treating serious burns, severe shock and a number of grave diseases.

Artificial hibernation uses the principle of a well-known natural defence mechanism of the body—the long winter sleep common to certain trees, plants and animals.

It combines the use of certain drugs which are non-toxic but which deaden the nervous system with actual refrigeration—putting the patient on ice.

It has been used on patients ranging from infancy to 85 years old.

Dr. Laborit first began thinking about the idea after watching patients who were in a state of shock. He decided that shock ought to be treated in a diametrically opposite way to the methods used previously.

The usual method has been to stimulate the body's defence reactions, by heating, applying stimulants and administering tonics.

Dr. Laborit reasoned that since the organism was using its last reserves of energy, it might be more reasonable to help anybody in shock, or about to enter it, by slowing down all living functions until the body reached a condition bordering upon inertia.

Working in Paris with research teams at the "central laboratory of physiology", and in the surgical department of the Vaugirard Hospital, he developed a so-called "lytic cocktail" which would put the entire automatic nervous system at rest.

Then, by applying cold, he slowed down vital functions restraining oxygen consumption, and organic combustion in the cells.

* * *

Plastics cause cancer?

PRACTICE of embedding plastics in the body might cause cancer in the patient years later, warned Columbia University experts.

Doctors said, however, that so far no proven instance had been reported of cancer developing in humans.

But they had had as high as 45 pc of rats develop cancer after plastics were embedded in their bodies.

In the rats and mice it took one to two years for cancers to appear.

Thus it might take 10 to 15 years in a human.

Several years ago these doctors wrapped one kidney of rats with cellophane to produce high blood pressure.

When they examined the bodies of these rats about two years later, they discovered cancer around the wrapped kidneys of seven of them.

At that time, surgeons were beginning to use cellophane and polyethylene plastic films experimentally to replace the membrane covering the brain, for tendon transplantations, to connect nerves and in operations on arteries and plastic operations on joints.

Since then, these and newer plastics have been used increasingly.

POPULAR SCIENCE QUIZ

Q. To what does the term "drilling mud" refer?

A. In the rotary method of digging oil wells a circulating fluid known as "drilling mud" is used. It is a mixture of water, clays, minerals and chemicals which is pumped down through the hollow drill pipe and circulated back to the surface in the space between the outside of the pipe and the walls of the hole.

This mud carries all drill cuttings from the bottom of the well to the surface and discharges them into a settling ditch or onto a vibrating screen. It also cools the cutting edge of the drilling bit by absorbing the heat generated in the drill pipe and the bit. The mud also deposits a clay sheath on the walls and bottom of the well thus preventing caving and loss of fluid into the formations being drilled.

The mixture also lubricates the drill pipe, seals off the unusually permeable low-pressure formations and closes the pores of formations which yield high-presssure gas or water. In addition, it holds the cuttings in suspension when circulation is stopped and supports part of the weight of the drill pipe and casing.

Common materials used in the drilling mud are soda ash, lime, vegetable gums, sodium hydroxide, quebracho, polyphosphates, carboxymethyl cellulose, bentonite and barite.

Q. What is "wood flour" and for what is it used?

A. Wood flour is a material produced by granulating and pulverising wood scraps. Until recently, it had been used as a "cheapener" or "bulking agent" in plastic moulding compositions, caulking compounds, &c., because it had seemed impossible to reunite the wooden fibres as well as they had been bonded by Nature.

However, a new process of bonding the fibres has produced a moulding compound which, when set, has the resistance to moisture of high-quality plastics and ceramics, yet can resist shocks and blows which would shatter plastic or ceramic ware of more expensive manufacture. The new moulding is used at present chiefly as tableware such as spoons, saucers, trays, salad bowls, and salad forks. The ware has thin walls, glassy surfaces and color effects.

The moulding compound is produced by mixing 80 parts of wood flour, by weight, to 20 parts of ureaformaldehyde resin. A thermo-setting resin in heat-fusible powder form aids the dispersal of the binder through the compound by centrifugal means and once set, the compound cannot be re-softened with heat.

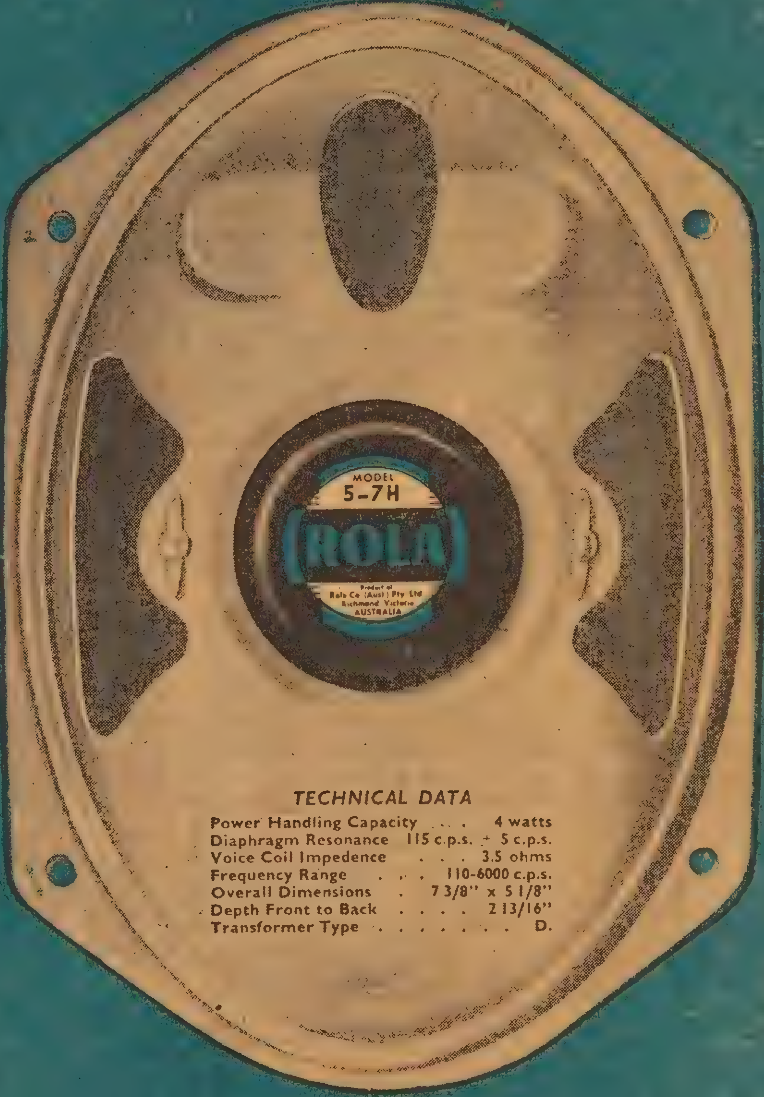
Q. What order of temperature can some new alloys withstand?

A. New high-strength heat-resisting alloys, called "superalloys", have been developed to withstand temperatures well over 1000 degrees Fahrenheit. The base alloys are nickel, cobalt and iron which comprise 65 pc or more of the materials by weight.

The high-strength heat-resisting alloys are made in electric furnaces, much as stainless steels are made. A total of 22 elements are used in the manufacture of these superalloys with as many as 12 elements included in the composition of some of them. Although less than 20,000 tons of these special alloys are sold annually as mill products in the US, their value is high.

Their present use is mostly of a military nature but they have numerous civil applications such as in commercial aircraft engines and improved gas turbines.

FOR BIG SET
PERFORMANCE
IN MIDGET SETS


MODEL
5-7H
ROLA
Product of
Rola Co (Aust) Pty Ltd
Richmond Victoria
AUSTRALIA

TECHNICAL DATA

Power Handling Capacity	4 watts
Diaphragm Resonance	115 c.p.s. ± 5 c.p.s.
Voice Coil Impedence	3.5 ohms
Frequency Range	110-6000 c.p.s.
Overall Dimensions	7 3/8" x 5 1/8"
Depth Front to Back	2 13/16"
Transformer Type	D.

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AND ALL LEADING WHOLESALERS.

TV for Norway

NORWAY is on her way into the television age, but doubting voices are still to be heard, both from the point of view of technical and financial difficulty and from those who consider television a "demoralising invention".

But the first steps have been taken and experimental transmitting material has been ordered.

"I have absolute faith in the possibilities of television in Norway," said Christian Rytter, the State Broadcasting Corporation engineer in charge of the experiments.

"There can be no doubt that plans for television in Norway can be realised, but it is impossible to say how long it will take."

In her television experiments, Norway starts with a number of natural handicaps.

The country is mountainous and large areas of it consist only of high mountains cut by deep valleys.

This makes television relay difficult and will probably necessitate the building of many stations or relay senders to transmit the beams from one mountain top to the next.

It has been mentioned, for example, that even the town of Drammen, only 33 miles from the capital, will have difficulty in receiving television transmitted from Oslo, owing to the intervening hills.

* * *

New anaesthetic

POTENT local anaesthetics can be made even more active by substituting sulphur for the carbonyl oxygen atom in the molecule, scientists at Sterling-Winthrop Research Institute, Rensselaer, NY, find.

One of the new anaesthetics they have produced is 1000 times more active than cocaine when applied to the cornea of a rabbit's eye. When used as a spinal anaesthetic for rabbits, anaesthesia lasted twice as long, with about one three-hundredth the dose, as compared with procaine.

With the increase in potency went a greater margin of safety with regard both to irritating effects and general toxicity.

The new, potent local anaesthetic is known so far only by the code name, WIN 4510.

* * *

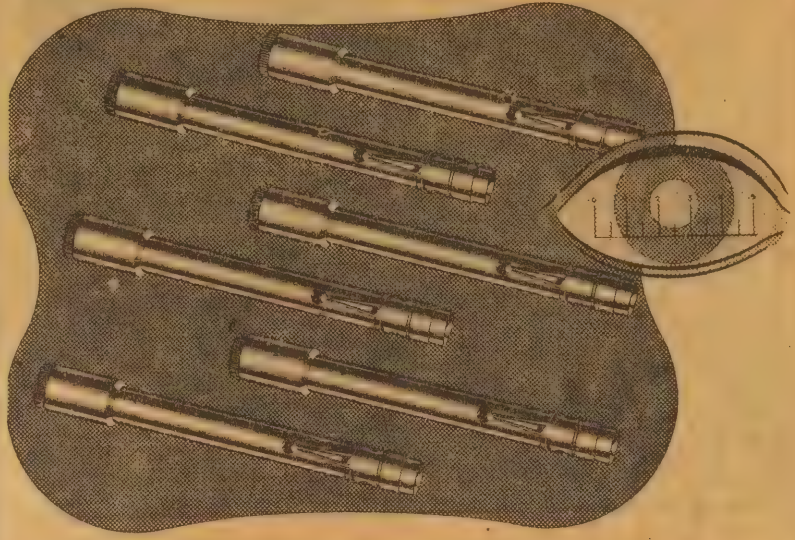
Threaded nail

A FLOORING nail with a threaded shank has proved that it is highly superior to ordinary flooring nails, and to "cut nails" with square-shaped shanks.

The threaded nail is lighter and cheaper than cut nails, drives into the wood with less effort, cuts the danger of splitting the flooring during nailing, assures tighter fastening and eliminates loose, squeaky, springy or buckled flooring under normal service conditions.

Dr. E. George Stern, director of the Virginia Polytechnic Institute Wood Research Laboratory, Blacksburg, found in year-long tests that the threaded nail was 53 pc to 570 pc more efficient than plain-shanked brads, and 15 pc to 301 pc more efficient than cut nails.

The threaded fastener was tested under rigorous conditions in wood samples that were systematically soaked in water, then dried to various degrees.



PERSONAL PROTECTION

THE KERSHAW POCKET DOSIMETER

Workers in the nuclear physics and radiography fields cannot afford to be without some form of radiation monitor to determine the total dosage received over any period.

The Kershaw Pocket Dosimeter is the ideal unit — a personal monitor for indicating the integrated doses of Gamma and Hard X-ray radiation received by an individual over any period.

In the shape of a fountain pen measuring less than five inches in length, it is conveniently clipped in the pocket. To determine the accumulated radiation exposure the Dosimeter is held toward a light source and an integral graticule, calibrated to a maximum of 500 milliroentgens, accurately indicates the total dose. A quartz fibre, which moves across the graticule in response to the dose received, is reset to zero by a charging unit.

A direct reading of Exposure is available. It is, therefore, vastly superior to the film-badge type monitor.

THE CINTEL PORTABLE RATEMETER

For location and rough assaying of radio-active elements and minerals that emit gamma-rays, the Cintel Portable Ratemeter consists of a probe unit carried in the hand, and a Battery and Meter Unit, worn on the operator's chest, and provided with three ranges giving full scale values of 80, 400 and 2,000 counts per min. Earphones are provided, thus avoiding the necessity of continuous observation of the meter.

For full particulars contact Test Instruments Dept.

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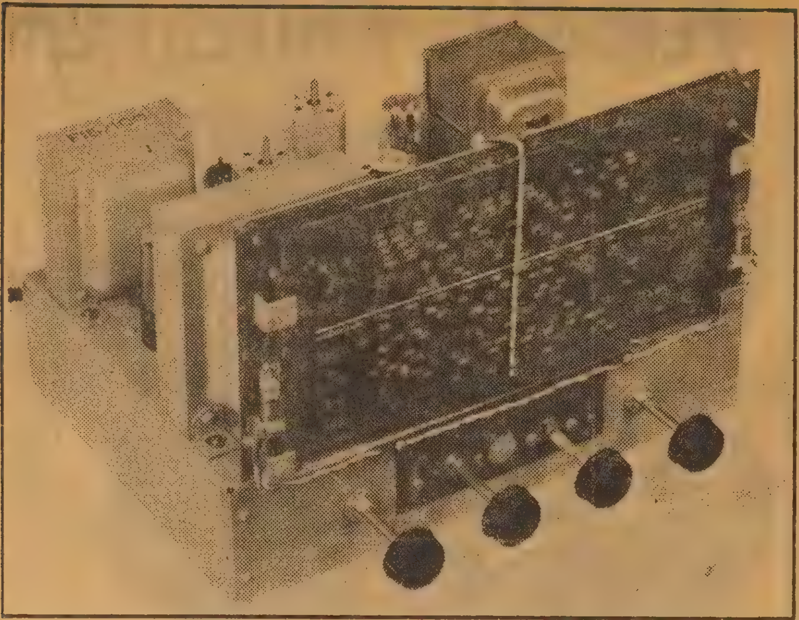


In this front view, the knobs are from the left—volume, selectivity, tuning and tone.

BUILD THE WIDE-BAND SEVEN

Here is an excellent wide-band radiogram which packs plenty of punch. It features variable selectivity, a push-pull audio end and a novel tone control. With six valves plus a rectifier and constructed on the Wide-Band Six chassis, it will fill your requirement for an ideal set in the home.

by Raymond Howe

BACK in October, 1952, we described a wide-band radiogram, employing a bandpass aerial filter and 1900 Kc IF channel, exactly as used in the wide-band tuner of the August, 1952, issue.

The idea of obtaining wide-range audio response from a superhet tuner caught the imagination of many and, judging by the sale of coil kits, large numbers of both the tuner and radiogram have been constructed. Reports as to its performance generally were most enthusiastic.

Unfortunately, however, a few readers were disappointed, not so much by the performance of the tuner as such, but by the peculiarity of their location, which proved unfavorable for wide-band AM reception.

DAYLIGHT SENSITIVITY

During daylight hours, the tuner did all that we claimed for it — ample sensitivity, low distortion and true wide-band reproduction. However, as evening drew on, sideband splatter from distant regional and New Zealand stations would begin to ride into the local channels. The difficulty was most noticeable in seaboard areas, where the local transmitters were weakened in relation to more distant ones.

The same trouble must obviously occur with any tuner having an equally wide bandpass, and the only obvious answer was some system of variable selectivity.

Working on this basis, you may remember, we combined the idea of an aerial bandpass circuit with our earlier scheme of switching out one IF transformer in a 455 Kc channel. The result — The Playmaster Wide-Range Tuner No. 2—employed an aerial bandpass circuit and a 455 Kc IF channel, with one transformer loaded and the other capable of being switched in or out at will.

EQUAL PERFORMANCE

In the wide position, the tuner duplicated almost exactly the characteristics of the earlier 1900 Kc version—in fact, it was a trifle better. In the narrow position, the selectivity was approximately the same as a normal superhet tuner.

The cost? Merely a couple of extra small components and a cheap switch, providing virtually two tuners in one.

This same tuning system makes our new radiogram a really versatile set. It can serve both the metropolitan and general country areas, giving wide-band reception of signals of sufficient strength, and, at the flick of a switch, more selectivity for signals subject to interference during the evening hours.

With wide-band facilities, a necessary feature is the whistle filter unit to attenuate the 10 Kc adjacent channel hetrodynes. This filter produces a sharply defined trough in the response at 10 Kc and effectively eliminates the annoying whistle.

FILTER INDUCTOR

The 100 mH inductor used in the filter is usually supplied as part of the wide-band coil kit. Its adjustment will be detailed later.

In the audio end, we wanted sufficient gain to give full output with a crystal pick-up after allowing for a reasonable amount of negative feedback, some type of "single-knob" tone control, and rather more audio power than is available from a standard set.

Push-pull output was indicated and even allowing for one triode section as a cathode-follower for the whistle filter unit, we achieved the desired result in four valves. With the rectifier, this brings the total number of valves for the tuner and amplifier to seven.

Treating the circuit design in greater detail, you will see that we have retained the miniature 9-pin converter in the first stage. The 6AE8 could be used here if the appropriate changes are made in the pin connections.

The valve operates with 85 volts on both the hexode screen and the triode oscillator anode at the "no signal" condition and at a bias of about minus 2 volts.

CRITICAL COMPONENTS

The bandpass aerial filter already mentioned contains two capacitors whose values are critical. These are the .02 mfd "bottom" coupling capacitor and the 4 pf "top" coupling capacitor. The .02 mfd also acts as an AVC line bypass and its value should not be altered unless the coil manufacturer's data suggests so.

The "top" coupling capacitor value may vary slightly with brand of coil manufacture, but you will be very close to the mark with a miniature 4.7 pf ceramic type.

Looking at the response with signal generator and meters, we preferred a value slightly less than this with the particular brand of coils used. That's why the underneath photograph shows this capacitor made up with about 1¾in. of 7/0.010 plastic-covered hook-up wire. However, the difference could be noticed with alignment equipment only. For all practical purposes, either form of capacitor would do.

In the combined IF stage and second detector we used the 6N8. This operates at the "no signal" condition with 85 volts on the screen and minus 2 volts on the grid supplied via the AVC line.

The variable selectivity switch is wired into this stage such that in position 1 both windings of IFT2 are shorted out and the coupling from the 6N8 anode to the detector diode is achieved with a resistance-capacitance network. In position 2 both windings of IFT2 are brought into circuit again and the .02 megohm resistor in the plate feed shorted out.

The plate feed of the 6N8 is decoupled from the HT line to reduce hum injection into the diode circuit via the coupling network.

DETECTOR OUTPUT

The output from the detector is fed to a cathode-follower, which then feeds at low impedance into the whistle filter circuit. The low impedance feed for the filter is a necessary condition for its satisfactory operation.

After the whistle filter the signal is stepped down in a ratio of about 3 to 1 further to reduce any hum which may appear in the high impedance diode circuit. The third section of the switch selects the pick-up channel, radio "normal" or radio "wide-band."

The first audio stage is really the tone control stage, but it provides a small amount of gain at middle frequencies.

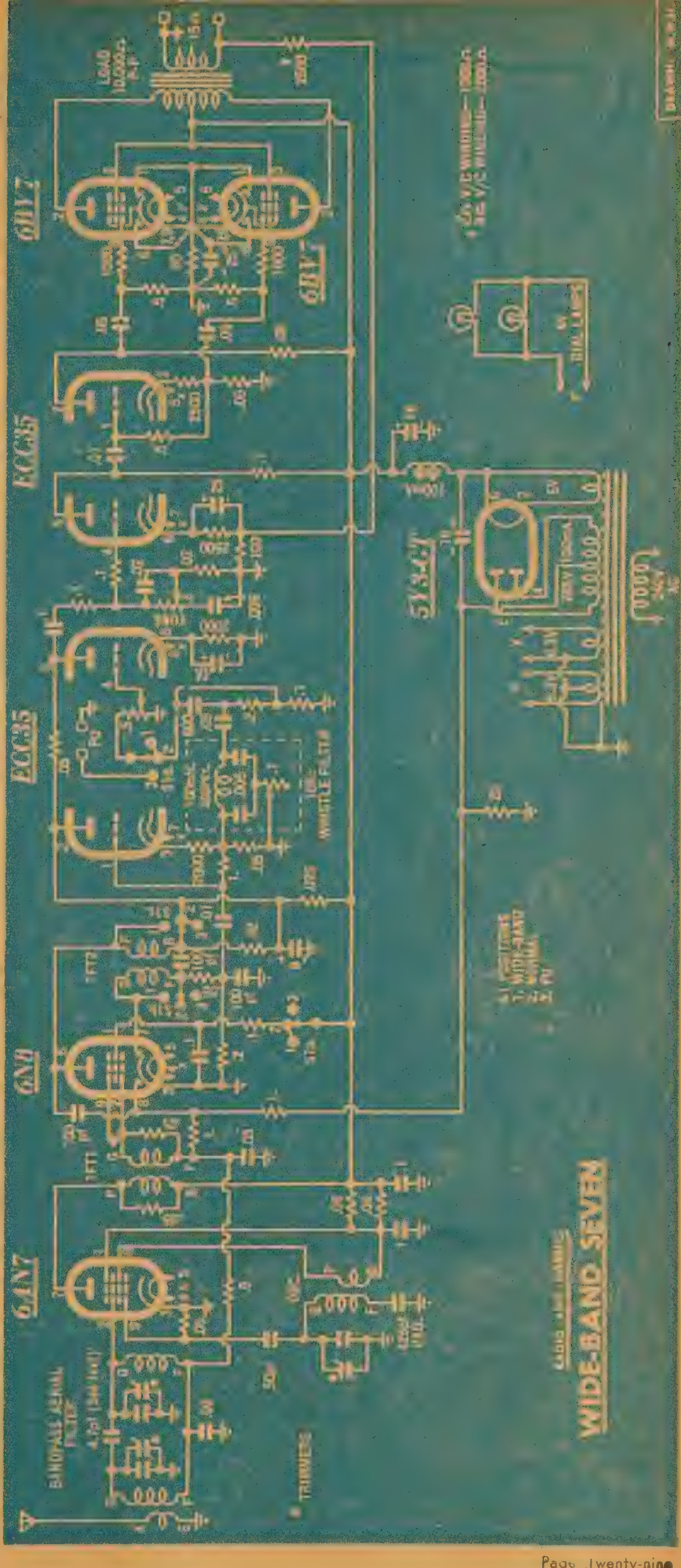
When the moving arm of the tone control shorts out the .02 mfd capacitor the response of the audio end is level. With the control arm at the other extreme, a bass boost of some 10 to 12 db is introduced, together with a small degree of treble cut.

PU RESPONSE

A standard crystal pick-up when playing a standard 78 recording will have a tapering response toward the treble end. This is quite acceptable as it tends to limit the amount of surface noise from the disc. The tone control can then be left in the "level" position.

A similar tapering treble response in LP crystal heads tends to neutralise some of the treble pre-emphasis included in the recording characteristic. The tone control can quite easily take care of the remaining pre-emphasis and also lifts the bass end. In practice, the tone control will be adjusted to suit the individual ear.

The second twin-triode provides a stage of voltage amplification and the phase-splitting stage to drive the push-pull output valves. The 1000 ohm resistors in series with each 6BV7 grid form a standard precau-



Here is the complete circuit diagram. The usual convention for tone control wiring is for bass boost to occur when the control is full left. The whistle filter components are those contained within the dotted line.

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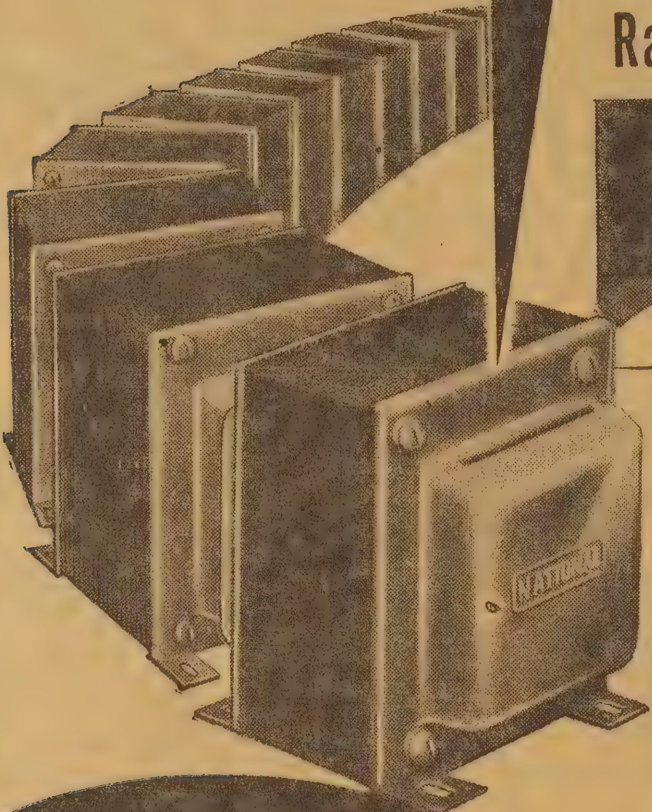

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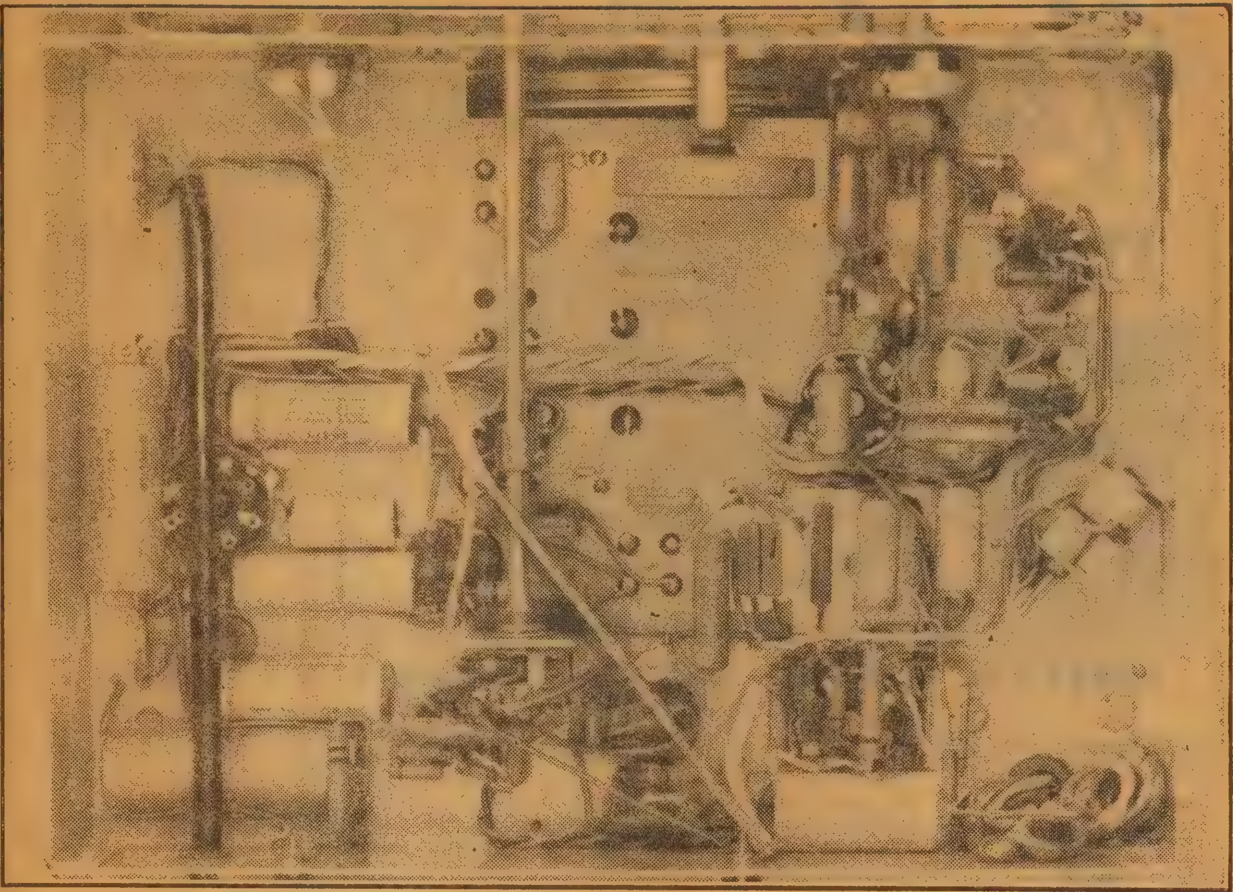

The chassis allows plenty of room for components. Note the whistle filter coil mounted at an angle on a small bracket to the extreme right of the picture. Swivel it around for lowest hum pick-up. Put a shield over it if you like. Do not earth the volume control case to the shielded braid.

tionary measure against parasitic oscillation in high Gm valves.

Negative feedback is taken from the output transformer voice coil winding back to the cathode circuit of the voltage amplifier stage. The gain reduction is of the order of 16 db. It tends to improve generally, the audio response of the audio end.

The value of the feedback resistor is dependent upon the nominal impedance of the voice coil winding, the value given being for a 15 ohm winding. Values for 8 ohm and 2 ohm windings are given on the circuit diagram.

The power supply delivers about 260 volts at 100 mA through a filter of 15 henries inductance and a pair of 16 mfd electrolytics. The voltage developed across the 20 ohm back-bias resistor between the transformer centre-tap and chassis is introduced into the AVC line by returning the AVC diode load resistor to this point.

On the question of choice of output transformer we could well repeat the remarks made in the article on the Wide-Band Six of the October, 1952.

PARTS LIST

1 chassis $12\frac{1}{2}$in x $9\frac{1}{4}$in x $2\frac{3}{4}$in. (Wide-Band Six).
1 power transformer 285V a side 100mA 6.3V 2A CT, 6.3V 2A, 5V 2A.
1 100mA filter choke.
1 output transformer 10,000 ohms centre-tapped with 15 ohm secondary tapped.
1 3-section miniature gang tuning capacitor.
1 dial with glass to suit gang (USL46).
1 set bandpass aerial filter coils, broadcast band (2 coils).
1 broadcast oscillator coil to suit 6AN7 (or similar) for 455 Kc IF.
2 standard 455 Kc IF transformers.
1 10 Kc whistle filter coil (approx. 100mH).
3 gang-section trimmer capacitors.
4 9-pin miniature valve sockets, 3 octal sockets, 1 4-pin miniature plug and socket.
1 4-pole, 3-position switch.

VALVES

1 6AN7, 1 6N8, 2 ECC35,2 6BV7,1 5Y3GT.

CAPACITORS

4 25 mfd 40PV electrolytics, 2 16 mfd 525PV electrolytics, 1 8 mfd 525PV electro., 4 .1 mfd 350WV or higher, 4 .05 mfd 350WV or higher, 2 .02 mfd, 2 .01 mfd, 1 .005 mfd tubular, 2 .005 mfd mica, 1 500 pf 1 425 pf mica (low tolerance), 3 100 pf. 1 50 pf, 1 4.7 pf ceramic.

RESISTORS

3 1 meg. $\frac{1}{2}$w, 4 .5 meg. $\frac{1}{2}$w, 2 .5 meg. potentiometers, 2 .2 meg. $\frac{1}{2}$w, 2 .1 meg. 1w, 3 .1 meg. $\frac{1}{2}$w, 1 .1 meg potentiometer, 2 .06 meg. 1w (or 1 .03 meg. 2w), 4 .05 meg. 1w, 4 .05 meg. $\frac{1}{2}$w, 1 .02 meg. 1w, 1 .02 meg. $\frac{1}{2}$w, 1 .025 meg 1w, 5 2500 ohm $\frac{1}{2}$w, 2 1000 ohm $\frac{1}{2}$w, 1 100ohm $\frac{1}{2}$w, 1 60 ohm $\frac{1}{2}$w, (or 1 100 ohm and 1 200 ohm in parallel) 1 20 ohm $\frac{1}{2}$w.

SUNDRIES

4 knobs, 4 terminals (2 red, 2 black), 1 $\frac{1}{4}$in to $\frac{1}{4}$in coupling, short length of $\frac{1}{4}$in rod, 2 6V dial lamps, 3 2-tag, 3 3-tag, 1 4-tag, 1 7-tag and 1 8-tag mounting strips, 2ft to 3ft of shielded hook-up wire, power flex and 3-pin plug, tinned copper wire, hook-up wire, grommets, nuts, bolts, lugs, solder, etc.

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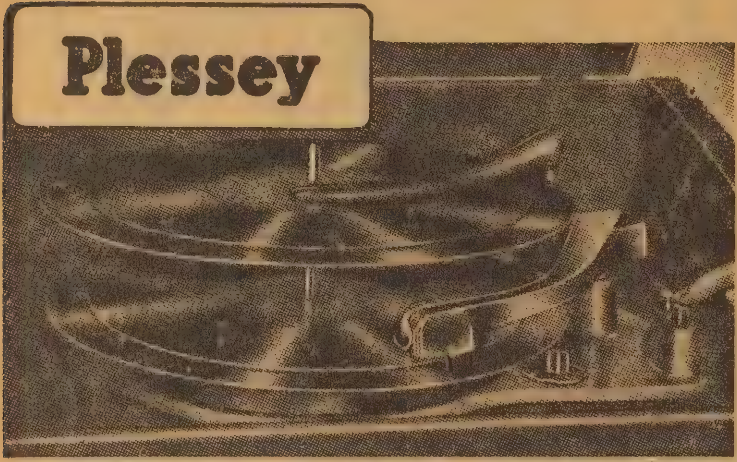

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	PRIMARY	SECONDARY	DB+—	CPS			
893-23	5000, 7000	2, 3.7, 8, 12.5	1	*40-15,000	5	SINGLE 6V6G, 6AQ5 ETC, TO VC	28/3
894-23	500	2, 3.7, 8, 12.5	2	50-10,000	5	LINE TO VOICE COIL	16/-
900-22	2500, 5000	2, 3.7, 8, 12.5, 15	1	*40-15,000	15	SINGLE 807, EL34 ETC, TO VC	57/6
896-9	8000 10,000	2, 3.7, 8, 12.5, 15	1	30-15,000	15	PP 6V6G's A OR ABI TO VC	62/6
897-9	8000 10,000	100, 125, 166, 250, 500	1	30-15,000	15	PP 6V6G's A OR ABI TO LINE	62/6
763-9	3000, 5000	2, 3.7, 8, 12.5, 15	1	40-20,000	15	PP 2A3's A OR ABI TO VC	62/6
809-26	500	2, 3.7, 8, 12.5, 15	1	50-20,000	15	LINE TO VOICE COIL	42/6
870-26	10,000	2 or 8	1	*20-20,000	6**	PP 6V6G's OR 807's AS TRIODES	57/6
871-9	10,000	2 or 8	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
872-9	10,000	3.7 or 15	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
891-22	6600	83, 100, 125, 166, 250, 500	1	50-12,000	35	PP 807's ABI TO LINE	82/6
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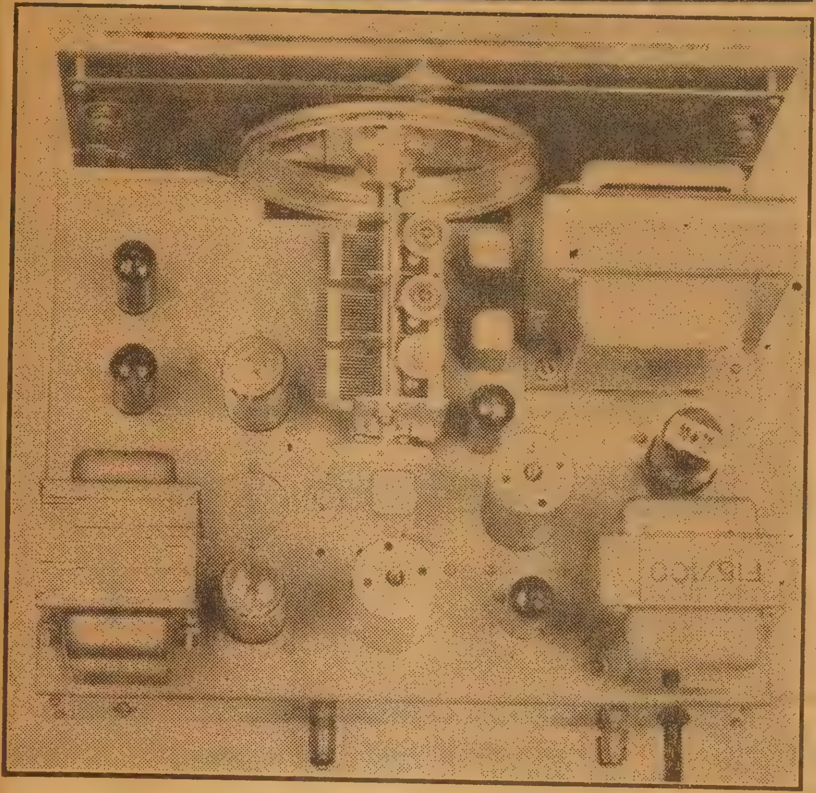
WIDE-BAND SEVEN PLAN VIEW



To the right of the gang and running toward the rear are the bandpass aerial coils, 6AN7, IFT1 and 6N8 with IFT2 and the first ECC35 to the left. The oscillator coil is at the rear of the gang with the whistle filter pot to the left. To the left of the gang are the second ECC35 and the two 6BV7's. The 5Y3GT is at the right between the power transformer and filter choke.

You may intend using a standard speaker transformer for the time being, possibly expanding later to a good quality job. If so, mount the speaker transformer on the chassis to keep the plate lead length down.

On the other hand, good quality speakers do not normally carry a speaker transformer. You are then faced with the decision as to the quality and type of output transformer which you should buy.

Of recent times, many people have purchased the Rola 12-Ox, for example, and used an appropriate transformer to feed into its 2 ohm voice coil. The extended range of the speaker has accentuated faults and bad portions of 78 rpm discs and discrepancies in quality of radio programs transmitted from discs.

TOP-CUT FILTER

An effective answer to the problem is to use a variable top-cut filter in the voice coil circuit having cut-off frequencies of about 6.5 Kc and 8.5 Kc. As these filters are practical for 15 ohm voice coil impedances only, it is necessary to come out from the set at 15 ohms through the filter and then through a step-down transformer to 2 ohms for the speaker voice coil.

However, we suggest that you consider a wide-range output transformer now available which has a 15 ohm secondary winding tapped at various impedances including 8 ohms and 2 ohms. It will thus feed any of the good quality speakers available with the added advantage that it permits a voice coil filter to be used at 15 ohms in the manner mentioned above.

(As a matter of interest to readers who already have a good quality speaker with a low impedance voice coil and are troubled with some of the problems of extended range listening we would suggest that you read the article on Page 91 of the September, 1952, issue.)

To reduce ready-made chassis supply problems we investigated the use of an existing design. It turned out that the chassis for the Wide-Band Six would do the job.

The block lines under the chassis rear view give the component placement on the chassis top. The underneath photograph shows the general grouping of the minor components. Orientation of valve sockets, coils and IF transformers is important if the length of "hot" plate and grid is to be kept at a minimum.

SOCKET ORIENTATION

As a guide, we arranged them this way. The gap between pins 1 and 9 of the 6AN7 and 6N8 sockets is toward the filter choke, the keyway of the first ECC35 socket toward the output socket, that of the second ECC35 toward the dial drum, the gap in the rear 6BV7 toward the chassis side and that of the other 6BV7 toward the tone control.

For the coils, the grid pin is placed nearest the gang section connections. The 1FT1 has only one logical orientation, the 1FT2 could be

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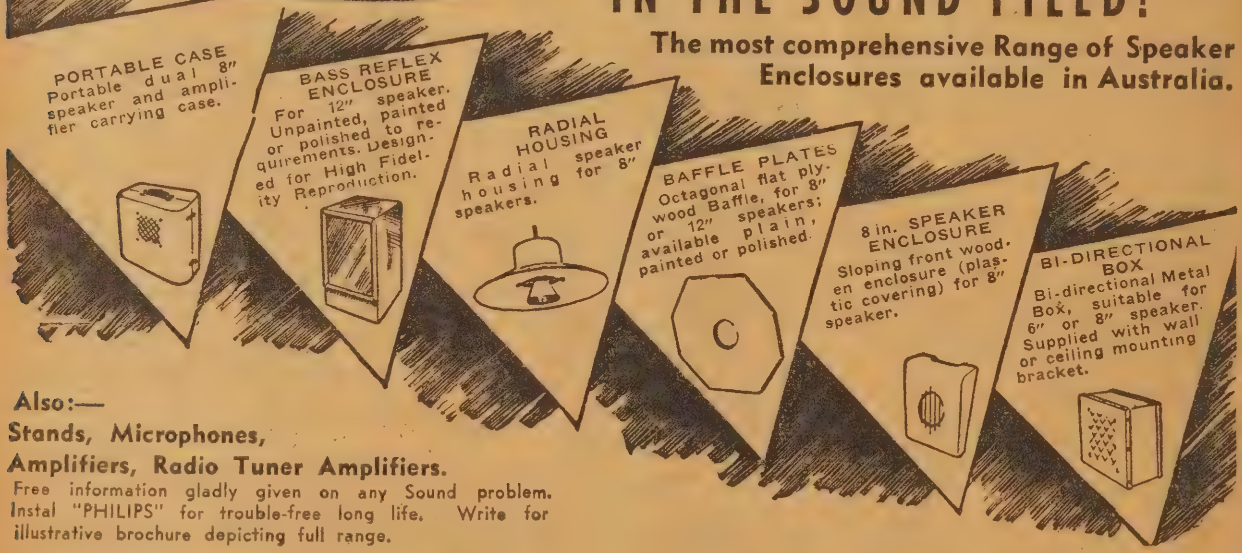

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wired in either of two possible positions of mounting.

Solder lugs could be placed under many of the nuts and all earth points joined together with a run of light gauge tinned copper wire. Tag mounting strips are very handy for wiring.

We used a 3-tag under the far transformer bolt and the far filter choke bolt, a 4-tag under a filter choke bolt near the aerial and earth terminals, a 3-tag under IFT2 nut near the chassis rear and a 2-tag under the opposite nut, a 7-tag under the bolt holding the blanking plate over the unused whistle filter can hole, a 2-tag under each front bolt of the 6BV7 sockets and an 8-tag in line with the tone control.

Use ½-watt resistors where applicable as it makes for easier wiring. The parts list will be your guide here. Where the same value is shown in ½-watt and 1-watt size, the one connecting to the HT line at any point will be the 1-watt size.

SERVES AS SHIELD

The centre spigot of the miniature valve sockets acts as a shield between the pins and should be earthed. The octal sockets used are those having a metal surround. This is very handy for making earth connections.

You will note that the selectivity switch is mounted on a small bracket near the 6N8 socket and the shaft is brought out with the other knobs through a length of ¼in rod and a coupling. This is necessary to keep the leads short to IFT2.

The amount of bass boost available from the tone control made it necessary to orientate the whistle filter inductor so that induction from stray magnetic fields was at a minimum. We were able to eliminate this entirely by mounting it on a small bracket attached to one of the output transformer mounting bolts, while still permitting adjustment to the core slug. The position is rather critical.

We have dealt with the alignment before in the August and September, 1952, issues, but this is briefly the procedure. Assuming that you have a signal generator, couple it to the converter grid, set to 455 Kc and proceed to align the IF transformers with the selectivity switch in the "normal" position.

See that the dial pointer has equal overlap at each end of its travel. Set the generator to 600 Kc and adjust the oscillator coil slug until the signal is tuned in on the dial at the 600 Kc mark.

BANDPASS ALIGNMENT

Transfer the signal generator output to the aerial and earth terminals of the set and set the selectivity switch in the "wide-band" position. Solder one end of a .01 meg. to .02 meg. resistor to the AVC lug on one of the bandpass aerial coils and then bridge it across one of the bandpass coil grid windings.

Now adjust the slug in the other aerial coil (the one not so shunted) for maximum signal, preferably as read on an output meter. Transfer the shunting resistor across the grid winding of the other aerial coil and adjust the slug of the un-shunted coil for maximum signal.

Repeat the procedure once or twice and then tune the signal generator slowly across the 600 Kc mark. You should find a peak in level on each side of the 600 Kc point and displaced therefrom by about 7 to 9 Kc. If there is much indication of unbalance or general lack of symmetry, try reducing the value of the "top" coupling capacitor.

About 1¾in to 2in of tightly twisted plastic hook-up should serve quite well as the "top" coupling for most brands of bandpass aerial coils. On the other hand, if you put in a 4.7 pf miniature ceramic, you won't be far out. Remember that you will probably need to shunt both windings of IFT 1 for the broadband characteristic to be realised.

The high frequency end adjustment follows normal procedure. Simply tune in a known station between 1200 and 1300 Kc, or set the generator somewhere around there, and adjust the oscillator trimmer on the gang to bring the signal in at the correct spot on the dial. Adjust both aerial circuit trimmers for maximum signal. It would be a good plan to repeat the whole procedure.

To set the whistle filter, tune around the dial in the evening, and choose the spot where the whistle is the worst. Adjust the .1 meg. potentiometer for minimum whistle, then adjust the slug of the 100 mH inductor for a further reduction in whistle, readjusting the potentiometer at each step. As you get nearer the mark, the adjustments will become rather critical with the whistle disappearing completely.

The volume control should be fully advanced and the generator output adjusted to give sufficient level for workable alignment. You can still make a fairly good job of the alignment without a generator by tuning in appropriate stations. As space does not permit elaboration here, we refer you to the article on the Playmaster Tuner No. 2 of the July 1953, issue.

The last four paragraphs of that article will also explain the use for and possible variations of the value of the 500 pf capacitor connecting to section S1d of the switch.

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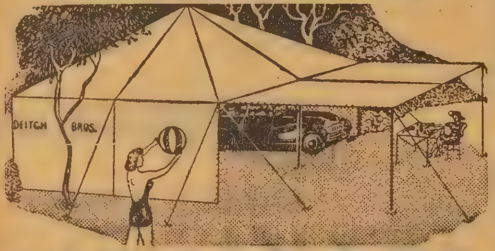

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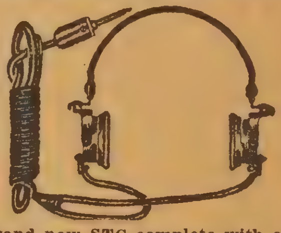

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FROM THE SERVICEMAN WHO TELLS

Every so often a serviceman will strike a set which has so many faults, both large and small, that the reconditioning of it can only be regarded as a major operation. Such a set was the one I want to write about this month and there is so much to tell that it makes a complete article in itself.

THE set was a pre-war model 5-valve mantel-type employing a 6A8 metal valve as converter, 6K7-GT IF amplifier, 6Q7-GT detector and audio amplifier, 25A6 metal output valve, and 5Z4 (also metal) rectifier. Of the two-"GT" types I will have more to say later because the full significance of these types did not occur to me immediately.

As I received it, the set was completely inoperative and the owner explained that he had bought the set cheap and was prepared to spend a fair amount in repairs, reasoning that it would still be a cheap set. The next point he made was that he suspected that the 6A8 was faulty and that he had purchased a new one to replace it. The snag was that it wouldn't fit and he wanted to know whether I could either supply one which would fit, or modify the set to accommodate the existing one.

DIFFERENT SIZE

When he produced the valve, I realised why it wouldn't fit. It was a 6A8G which is a very different proposition, physically speaking, from the 6A8 metal valve with which the set had been originally equipped. This latter valve is only about 2½in. high when seated in the socket, and the cabinet had been designed on the basis of this and the other small valves in the set. Consequently there was no room for the "G" type envelope which is about 3¾in high when seated.

I was beginning to piece together something of the history of the set by this time. It seemed fairly obvious that it had been purchased on the understanding that it required a new valve (the 6A8) but that no mention had been made of the important fact that the 6A8 (metal valve) is no longer available in this country and that the normal replacement was too large.

Actually, there are several modern converters, such as the X6IM, ECH35, &c., which would have been quite suitable as replacements, but since the owner had, in his ignorance, already purchased the 6A8G, we were more or less stuck with the thing.

SOCKET LOWERED

I confirmed that the original valve was really faulty (it had an open filament) and then set about examining the chassis to see what chance there was of lowering the socket without a major alteration. Fortunately, it appeared that this might be quite feasible, the idea being to mount the socket below chassis level by means of spacers.

The chassis was only a shallow one, but I calculated that if I could "score" about a quarter of an inch, or perhaps a fraction more, it would be enough. Since there appeared to be no major components in the way, I reasoned it was worth a try.

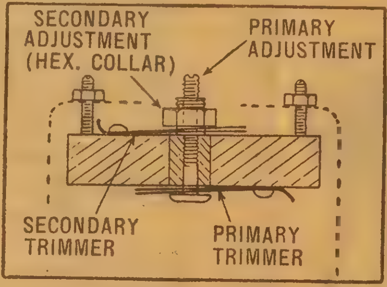
The first step was to remove the existing single hole mounting socket and mark out two 1-8in clearance holes on either side of the socket hole to suit a replacement type socket. Such a socket was then fitted, using ¼in spacers and a few washers to drop it by the required amount below chassis level. This provided just enough clearance to allow the valve to fit inside the cabinet and, having satisfied myself on this point, I proceeded to re-wire the socket.

WIRING ERROR?

It was while I was tracing out a few wires in the process that my attention was drawn to what appeared to be an error in the power supply wiring. I was first attracted by the fact that both the positive leads from the two electrolytics came to the same point on the HT line. This suggested that the filter choke (in this case the speaker field) was in the negative side of the supply, which was quite a popular arrangement at one time.

When this circuit is used, the first electrolytic is normally connected between the HT line and the transformer centre tap, while the second electrolytic is between HT and chassis. As it was, however, it was quite obvious that both electrolytics were connected to chassis, meaning that they were, in effect, simply connected in parallel.

It also meant that the power supply was operating without a first electrolytic and was, therefore, a choke input filter. Now, choke input filters are very useful things in their proper place, but they are awfully wasteful of voltage (if one CAN waste voltage) and not the type of thing usually found in a mantel receiver.



IF's with both adjustments at one end were quite popular a few years ago and this is one form of construction. A screwdriver is required for one adjustment and a box spanner for the other. The arrangement is not always obvious and may trick the beginner.

Reasoning thus, I decided to restore the circuit to the more conventional arrangement, and started looking for the transformer centre tap. When I found it I realised how the error had occurred, for it was right alongside the earth point of one electrolytic. It took only a few moments to shift the connection across, and I felt that the HT voltage would benefit at least to some extent.

Later I was able to confirm this, temporary restoration of the circuit to its original form dropping the voltage from 125 to about 95. (The figure of 125 was chosen to suit the 25A6.)

When the 6A8 socket wiring was complete and the set switched on, it commenced to show signs of life, but any satisfaction on this point was quickly dispelled when it was realised that the station calibrations were away off course, 2FC appearing somewhere around the 700 Kc mark and 2SM being slightly low in frequency.

This rather severe band compression suggested something far more serious than mere alignment drift, or even tampering, because there is not normally this much adjustment possible by ordinary means. The first possibility that occurred to me was that the padder circuit was involved, though the exact cause and nature of the trouble was yet to be determined.

DOUBLE PADDER

Examination of the padder showed it to be composed of two condensers in parallel, one being a fixed mica type of 300 pf and the other a variable type along the lines of a conventional compression type trimmer, though somewhat larger.

These were quite the usual thing in the days when adjustable padders were all the fashion and were usually classified by the rather unscientific method of specifying the number of plates employed. Thus a padder would be referred to as a "5 plate" or a "7 plate" type, with the additional information that a 5 plate would require a shunt condenser while a 7 plate would not. No one seemed to have thought of specifying the number of pf's involved!

Anyway, more detailed examination suggested that there had been some tampering with this part of the circuit, the adjusting screw having been removed and replaced the wrong way round, that is, with the head on the underside of the base plate. In this position it was completely useless and allowed the plates to spring open to their natural angle.

FIND THE REASON!

It appeared to be a three-plate assembly but, just to make it harder, there was a large "5" stamped on the base plate; suggesting that there had been "a certain amount of mucking about" here also.

Further weight was given to this theory when I noticed that the plate assembly was only screwed together,

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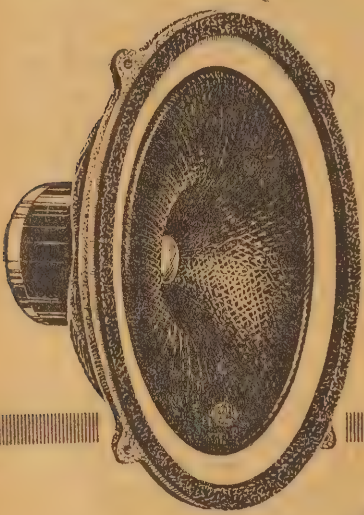

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rather than riveted, and that it would have been easy to remove a couple of plates. (I have given up trying to find a reason for the strange things people do to radio sets. In most cases they don't seem to need one.)

At this point I must admit that I made something of a snap decision when I might have been better advised to stop and think a little more carefully. In any case I decided to replace the old padder assembly with a new one, mainly on the assumption that it would be one less unknown quantity.

Fortunately the padder was one component which was easy of access and it only took me a few moments to fit a standard type adjustable padder capable of reaching the usual figure of 420 pf or thereabouts. A rough adjustment seemed to show promise and I was able to move 2FC toward its proper place on the dial.

Further adjustment brought it to within about 20 Kc of the calibration mark but at this point I had reached the limit of the padder adjustment. What was more, the padder was screwed right out and I imagine the total capacitance was not much more than 200 pf.

GROWING DOUBTS

The gain had improved somewhat, though the performance was far from impressive and was further marred by a definite tendency to oscillation at the low frequency end of the band. This was rather puzzling because oscillation is not usually associated with low gain.

By now there was a measure of doubt in my mind as to whether I was really on the right track. I took a few minutes off to think things over and do a few rough calculations. Sure enough, I soon realised that there was something very silly going on somewhere and the more I checked the sillier the whole thing seemed.

My first mistake had been in assuming that the compression of the stations was due to a reduced padder value because, in fact, such a fault would cause just the opposite effect, and tend to push 2FC off the top end of the dial. This was amply demonstrated by the fact that I had to reduce the new padder value to its minimum in order to move 2FC toward the low frequency end.

This being so, there seemed to be two possibilities: (1) that the set was designed for a padder of only 200 pf (approximately) and that the one I had taken out had been fitted in error or (2) that the IF channel was completely out of adjustment.

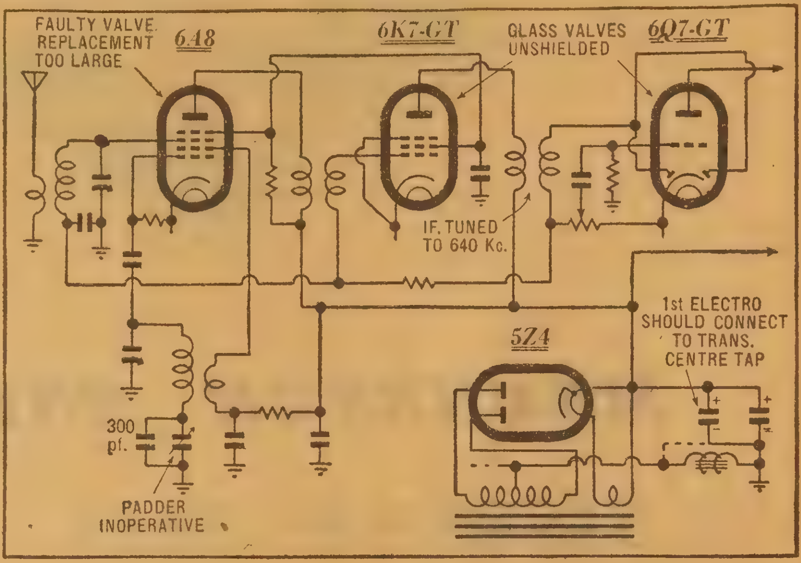
I.F. CHECK

But neither of these suggestions seemed very reasonable because it seemed most unlikely that a successful oscillator circuit could be designed around such a low value of padder or, alternatively that an IF channel could be so far out of adjustment, even assuming the fiddling of an unskilled type.

I decided that it was time to go back to scratch and start all over again, making sure this time (I hoped) that I was not side-tracked by too obvious faults.

The first thing to be done was to check the IF channel and make sure it really was on a reasonable frequency. With this much established it should not be difficult to make sense of the rest of the problem. Accordingly, I hitched up the generator and commenced looking for the appropriate adjustments.

For a few minutes I was somewhat puzzled because there only appeared to be one such adjustment, in the form of an eighth-inch diameter slotted screw, for each IF. This protruded from the top of the can in each case, but there was nothing from the bottom of the can as is usual. Not that it would have done much good because this part of each can was completely "built out".



This set seemed to be literally full of faults and many are shown here. Note particularly the muddled electrolytic connections. Tampered padders and mistuned IF's added to the confusion.

Then I had a closer look at the obvious adjustment and realised that I had been tricked again as I had been many years ago. The second adjustment was in the form of a hexagon collar outside the eighth-inch slotted screw, so that both adjustments were at the same end of the can. I must admit that this idea has some advantages, if only because one does not need to force one's way through a jungle of components to reach the lower adjustment.

On the other hand, I was faced with the immediate problem of finding a box spanner to suit the hexagon collar, it being necessary to ensure not only a good fit, but also that the spanner was deep enough to accommodate the length of eighth-inch screw. The situation was not made any easier by the presence of large quantities of "goo" which had been used to seal the adjustments.

Although it was obvious that these seals had been broken at some time, they were still sufficiently effective to gum up the threads.

Eventually I found a spanner which was a reasonably good fit and set about checking the response. Contrary to what I had expected, there was a definite response at 455 Kc and all the adjustments appeared to peak quite normally. In fact, as far as the tuning was concerned, the channel appeared to be quite in order.

However, the gain was another story, being extremely poor. So poor, in fact, that the generator was almost flat-out to force a signal through the set. To find out just where this loss was occurring I moved the generator from the converter grid to the IF grid. From this point I had difficulty in hearing any signal at all and when I did manage to force one through, I could not find any evidence of a peak, merely a broad band of signal becoming slightly stronger as I moved the generator toward the broadcast band.

Somewhat bewildered, I continued to increase the frequency, passing first the 500 Kc mark, then 550, then 600, with the signal coming up all the time. Eventually I found a peak at no less a frequency than 640 Kc—which was not a bad effort for an IF designed for 455 Kc!

What was even more surprising was the fact that it was not due to any actual fault in the transformer and I was able to set it back to 455 without any great difficulty. As I expected, this immediately changed the whole story. The gain of the IF channel was now extremely good, being in the order of 30 microvolts and rather better than the average set of this size.

The padder was also behaving in a more logical manner, tending to push 2FC off the low frequency end of the band and obviously needing to be screwed in. When this was done 2FC moved back toward its correct spot and was finally located there when the padder was set to a more or less normal value.

OSCILLATION GONE

Finally the oscillation at the low frequency end of the band had now vanished, in spite of the vast increase in sensitivity, and this may at first seem surprising. However, the most probable explanation is that the second IF, being tuned to roughly the same frequency as at the grid of the converter, was responding to the actual incoming signal rather than the converted signal, thus causing the set to behave more like a TRF than a superhet.

Admittedly, there was a correctly-tuned circuit between the input and second IF, but this would not be able to reject completely the unwanted signal. Add to this a certain amount of random coupling between the detector and the aerial and the stage was all set for feedback.

The only puzzling point which re-

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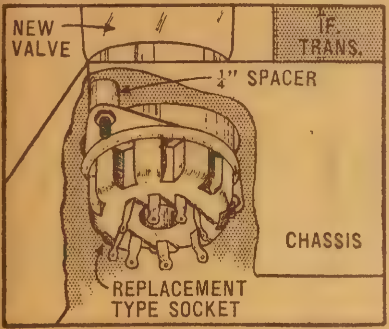
mains is why the second IF appeared to peak at 455 Kc when I first checked it. I'm very much afraid that that question will have to remain unanswered because I can offer no feasible explanation and I don't propose to upset the tuning of IF again just to find out. Suppose we just blame it on the gremlins.

But all my troubles were not yet over. Thus far I had contented myself with alignment adjustments which were reasonably accurate, but not exact, being more interested in knowing that the correct adjustment was capable of being made rather than actually making it. Now I set out to do the job properly.

VALVE SHIELDS

When it was done the performance was really good except that there was a definite "swishyness" about the tuning which suggested a tendency to oscillation, even though the set was quite stable when tuned to even a weak station. In searching for a possible reason I suddenly realised that neither the IF valve nor the detector were shielded and that this could well be the trouble. The IF valve in particular needs to be shielded and it would have to be a particularly good layout which could ignore this requirement.



The only way the larger 6A8G valve could be accommodated was by lowering the socket on spacers as shown. The scheme is quite a good one provided there is sufficient depth in the chassis.

I also evolved a theory as to why these valves were unshielded.. It seemed most logical that the set originally contained metal valves throughout and, since these use the metal shell as a shield, no additional shield was necessary.

However, when the two valves in question had passed out they had obviously been replaced with the glass equivalents, equally obviously by someone who had little knowledge of the finer points of valve replacement. Thus the little matter of providing a shield to replace the metal shell had been entirely overlooked.

REPLACEMENTS

As I had expected, the fitting of a simple shield to the IF amplifier was sufficient to remove this last trace and I considered the set now in first-class condition and ready to go back to its owner. When I did hand it back I advised him that there were quite a number of pitfalls in buying a second-hand set and that he might save a lot of bother the next time if he sought some skilled advice first.

Which brings me, quite naturally, to the subject of valve types and replacements. There were several manufacturers who, before the days of dollar shortages and import restrictions, designed most of their sets around valves imported either from the Continent or the United Sates.

The reason for this policy is not hard to appreciate. These sources provided a greater variety of valve types than were available from the local manufacturers and there was a great temptation to use multi-purpose types, such as combined power valves and rectifiers, separate pentodes and triodes in the one envelope, and so forth, in order to produce sets with a high performance and a (supposedly) minimum number of valves.

Some of the high voltage filament types, intended for series operation on 110-volt systems, were also frequently used, generally in an effort to emulate the American style "transformerless" mantel sets, even though many watts of power had to be wasted as heat when these were used on 240 volts.

Now there is no doubt that some of these schemes produced very attractive sets which had performance figures for a given number of valves which the more conservative manufacturers, who were content to use the locally-made product, could not match.

Which was all very nice—while it lasted. But now comes the pay-off. There must be literally thousands of these sets in operation which are only now beginning to give trouble in terms of valve failures, and the owners are realising that these valve types are extremely difficult, if not impossible, to obtain. The result is that the set must be either discarded completely or rebuilt to take the more conventional valves now available.

Anyone who has considered the problem of rebuilding some of these sets will know that I am not exaggerating when I say that it is often cheaper to discard them. This is particularly so because the original designers seldom wasted any room in laying out the chassis, so that additional sockets and other components which are necessary just cannot be accommodated.

Not all cases are as bad as that, of course, but even at the best the job is usually much more expensive than it should be.

Correction exposure meter

MR. H. C. BELL, author of last months article on the construction of an exposure meter, draws our attention to a slight error in the quoted dimensions of the case. These were given as 3½" x 2¼" x 1½" but should be 3½" x 2¼" x 1 1/8.", the last dimension, unfortunately, having been mis-read in transcribing from the original manuscript.

THE CINEMASCOPE—HOW IT WORKS

(Continued from Page 7)

With these changes, the standard theatre projector becomes compatible not only with CinemaScope projection but with every present-day sound film.

To run the new magnetic film, the projectionist has only to thread it through the new "Penthouse" sound head, the projection picture gate system. When threading only for optical or ordinary single-track sound, the projectionist utilises only the guide rollers in the "Penthouse"—the new magnetic sound head which has been designed for the four-track magnetic system — and then proceeds as he has in the past.

The new sound head is being produced by major projection companies, such as RCA, Westrex and General Precision, and probably by others. The only differences expected are those of detail design.

Selection of the sound system required for CinemaScope or standard films is not difficult, since these will be standard installations in the theatre. The special, amorphic lens required by the CinemaScope film to give the correct display of the wide picture is easily fitted.

The introduction of magnetic recording for films might well mark the end of the present-type sound track for theatre work. It has always been subject to many limitations in frequency and dynamic range, and loses noticeably with each printing.

Many of its limitations may be removed by the use of magnetic recording, and only time and use will tell whether the new medium is any more difficult to manage than the old.

Even if it has, the emphasis at the moment is on the new presentation, and if this succeeds, one sound recording system is obviously preferable to two.

Dielectric Heating cuts woodworking costs

(Continued from Page 21)

top and floor panels, as complete units. Each assembly is then moved into an RF heating press which cures the glued joints.

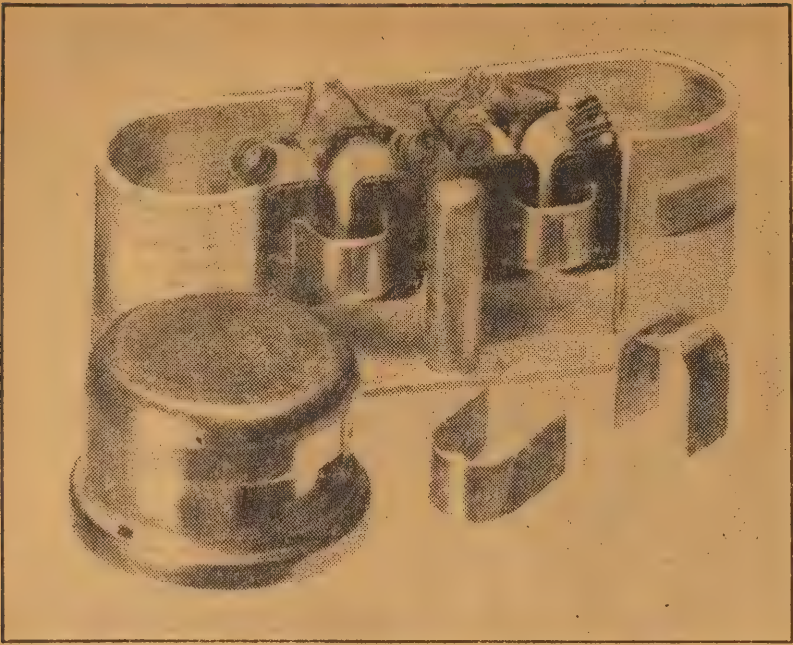
Glue-curing and forming operations for laminated clock cases, chair seats and backs, piano sections, sporting goods and other wood products are being done by through heating.

Generally a pair of dies existing from previously used methods is faced with sheet brass electrodes, these dies and installed electronic equipment being capable of handling production requirements.

Another advance by the woodworking industry has been its application of dielectric heating to the drying of hardwood lumber to a desired moisture content.

The 65-year-old plant of G. F. Mooney and Son, Inc., cures green-state white birch to be used in the handles of household and industrial tools in 12 to 15 hours by dielectric heating, compared to 12 to 36 days in conventional drying kilns or four to six months by open-air drying process.

This new system has made possible year-round cutting and drying of lumber and has enabled the company to reduce its lumber inventory by 60 to 70 pc and still meet customer requirements. Further, quality is maintained, the dried wood being completely free of warping and checking.



In the foreground is an R/P head housed in a chromium-plated pipe cap. At the rear is an experimental assembly containing an erase head (right) and an R/P head (left). The centre pillar has a guide track cut in its rear face and tracks can also be seen cut into the sides of the housing.

MAKE YOUR OWN TAPE HEADS

Ever since the idea of tape recording caught the fancy of our readers, it has produced a much-repeated question . . . "Can I make my own heads?" The answer, quite simply, is "possibly you can—and very cheaply too—provided you happen to be lucky with your stock of oddment bits and pieces." At least it's worth a trial and you'll stand to learn quite a few lessons in the attempt.

by Neville Williams

DURING the past few months we have managed ourselves to make several heads which worked quite well, using only those oddments and facilities available to an enthusiast. There's no special reason why you can't repeat the performance.

Let it be said at the outset that the ideas contained in this article aren't intended for those concerned with making heads for sale. Their approach to the subject must be a great deal more rigorous than the home builder's.

In fact, on a commercial basis, the very first step must be to eliminate the oddment and "fiddling" approach altogether and to settle on an approved design. After that, it's a matter of producing duplicate parts and evolving methods of assembly and control to ensure that each head is exactly similar to the one that went before.

PRECISION JOB

To say the least, this isn't easy, and the necessary degree of precision calls for facilities and jigs that are beyond the scope of the average enthusiast and his proverbial kitchen table.

Nevertheless, given enough patience and the aforesaid element of good fortune, you can make heads that work.

Fundamentally, of course, a magnetic head is a very simple device. It consists of one or more laminations bent or assembled in such a way that they form a magnetic path complete except for a fine gap.

One or more coils are wound around portion of the structure and leads taken away to the external circuit.

Audio currents, passing through the coil, create a varying magnetic flux across the gap, and this can be used to impress a magnetic pattern on the recording tape.

Conversely, if a magnetised tape is run past the gap, the magnetic pattern will produce a changing flux in the iron circuit, and induce corresponding currents in the coil. When coupled to a suitable amplifier, the end result can be heard as reproduced sound.

The design of amplifiers for tape recording and playback has been covered extensively in past issues, and there is no point in trying to repeat the discussion here. (See Radio and Hobbies for Nov., 1952, also Jan., March, July, 1953.)

It is sufficient to recall that, although the recording process does not require very much audio power, it does require the provision of high frequency "bias". This involves a bias oscillator stage and means to feed the supersonic output into the head, along with the signals which are to be recorded.

Then, again, the voltage available from a head during playback is very small and the circuit as a whole is prone to hum pickup. As a result, the amplifier requires just as much gain and at least as many precautions against hum and noise as would be required when working from a low output microphone.

Finally, for proper tonal balance, it is necessary to provide both bass and treble boost during record, or playback, or preferably both. If such is not provided, the reproduction will be characterised by a preponderance of middle frequencies—1000 to 3000 cps. For further information along these lines, we suggest you refer back to some of our earlier articles.

COIL IMPEDANCE

In facing up to the construction of a magnetic head, one of the outstanding problems is what to do about the coil (or coils).

Each coil may contain relatively few turns of fairly heavy wire—let's say 30-gauge or thereabouts. This would be known as a low impedance winding and it could only be fed from (or into) a transformer capable of matching it to a valve's plate or grid circuit. Similarly, it could only be fed from a low impedance secondary on the supersonic erase coil.

Low impedance coils are fairly easy to wind, but the necessity for using a matching transformer is a nuisance. This is particularly true on playback, where the transformer is prone to pick up hum from motors or power equipment. Ideally it should be a specially-shielded type and, as a result, is generally worth quite a few pounds.

At the other end of the scale are the so-called high impedance coils, which are wound with a large number of turns of very fine gauge wire. These coils are much harder to wind, but they do have the advantage that no matching transformers are required. They also happen to suit the various amplifiers and adaptors that we have described for home construction.

HAVE BEEN AVAILABLE

Winding your own high impedance coil would be a tricky business. You would have to make up some sort of a bobbin or former, find the wire or rob it from an old audio transformer, and, last but not least, invent some method of bringing out leads that aren't going to break the first time you try to solder them into a circuit.

Fortunately, there is one possible and simple solution for the home builder in the use of earphone bobbins and coils.

A few months back we remember seeing a box full of the tiny moulded formers offered ex-disposals for threepence a time. You may have bought up a few, or you may know where you can get some. In fact, we remember having seen some complete bobbins offered for a few pence a time and you may have bought some of them. This is where the element of luck starts to come in.

Then, again, you may have some old discarded earphones!

Unfortunately, not all bobbin assemblies are suitable for the job. In some cases the coil is layer-wound on paper, cemented to the iron pole tip. You apparently can't get these coils off in one piece without wrecking them. Other coils are wound in tiny moulded bobbins and these can be slipped off the pole pieces with a little care.

We managed to locate a few ready-wound bobbins and half our problem disappeared forthwith. Of the specifications, we'll have more to say later.

There are at least three basic methods of assembling magnetic heads.

SIMPLEST HEAD

The simplest of these merely involves passing a single lamination through a single coil and bringing the tip together as indicated in figure 1. If the ends of the lamination are cleaned and tinned first, then jammed into a narrow slit in a brass tube, the whole lot can be sweated together and provides a rigid assembly.

The solder film on the inner faces of the lamination keeps them slightly apart, spring in the metal ensures maximum pressure near the tips, and the cut in the tube can be carefully worked out to make sure that the gap is near a true vertical.

To finish the head, the surplus material should be filed partly away and the surface polished smooth with the finest possible emery paper. A couple of little guides can be added to keep the tape exactly over the gap and means contrived to anchor the leads.

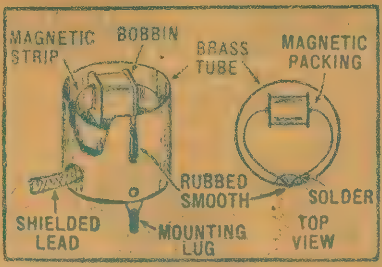


Figure 1: This diagram shows the construction of an elementary type of head, using a single bobbin and a single mumetal strip. Readers may care to experiment along these lines but results are not likely to be as good as from the design shown in Figure 3.

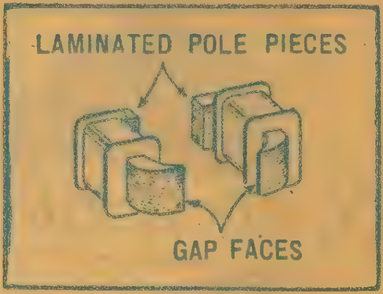


Figure 2: The more elaborate type commercial heads use twin coils and laminated pole pieces as above. Alternatively, moulded iron dust poles can be used. It is a difficult proposition at present for home construction.

One can be earthed on the metalwork and the remaining "active" lead brought out to the amplifier via a length of low capacitance shielded cable.

This type of head has been mentioned in overseas literature and offered for sale locally in kit form. We did not pursue it very far in our experiments because it appeared that the home builder could do better without much extra trouble.

A second type, the so-called "laminated" head, is illustrated in figure 2. In this case, the magnetic circuit is built up from two stacks of tiny laminations, each with its own coil. As finally connected, the coils are in-phase for signal currents but substantially out-of-phase for external fields. They are therefore inherently less prone to hum pick-up.

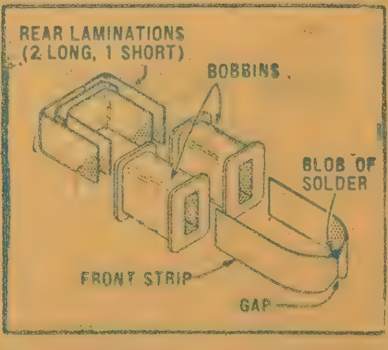


Figure 3: This method of assembly is entirely practical for home builders and can be done without special tools. We have made several quite successful erase and R/P heads, housing them as shown on the opposite page.

Laminated heads are widely used in commercial recorders, but they appear to be too complicated for home construction. Apart from the difficulty of obtaining the specially-shaped laminations, they must be accurately stacked and assembled within their respective coils.

The pole faces must then be ground and lapped absolutely true and some non-magnetic material placed in the gap while the whole unit is sweated together. Current practice is to use a fine shim or to "grow" a coating chemically on the pole face.

SUGGESTED METHOD

A variation of this technique, using pole pieces moulded from iron dust, may have some advantages. At the time of writing, however, there is no ready source of supply for the requisite "bits and pieces".

It would appear that the best method of head construction for the enthusiast is a variation of the strip technique, as illustrated in figure 3. It lends itself admirably to the use of earphone bobbins, which is a distinct advantage.

In brief, three laminations are bent around so that they enter the bobbins from the rear. The two outer laminations are long enough to pass right through the bobbins but the centre one is trimmed short, so that it barely enters the coil.

The lamination which contains the gap slips in from the front, and passes down between the two outer laminations till it butts against the short centre one. The gap assembly can therefore be removed in a few seconds for treatment or can be replaced just as easily with another one.

Like the laminated design, this type of head is widely used in commercial equipment and, if well constructed, is capable of excellent results.

In practice, heads may be made with pole faces approximately ¼in wide for full-track recording, or somewhat less than 1-8in wide for half-track work. We would suggest that the beginner content himself for a start with full-track heads, because they are easier to make and give you more signal to work with.

Half-track heads can follow when you've learned a few of the lessons.

Four distinct type of head have to be considered: record, playback, record-playback and erase.

TYPICAL GAPS

In a head intended purely for recording, the gap width is not reckoned to be particularly critical and a nominal figure of .001in is satisfactory.

A playback head should have the finest possible gap and this generally means something like .00025in for good treble response.

A head intended for both record and playback is generally a compromise between these two figures and .0004in is often aimed at.

By and large, figures of this order are merely of academic interest to the home constructor and he ca

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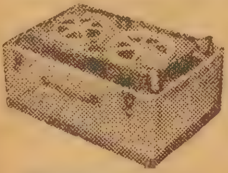

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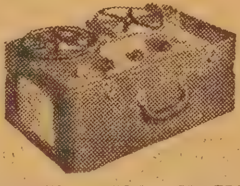

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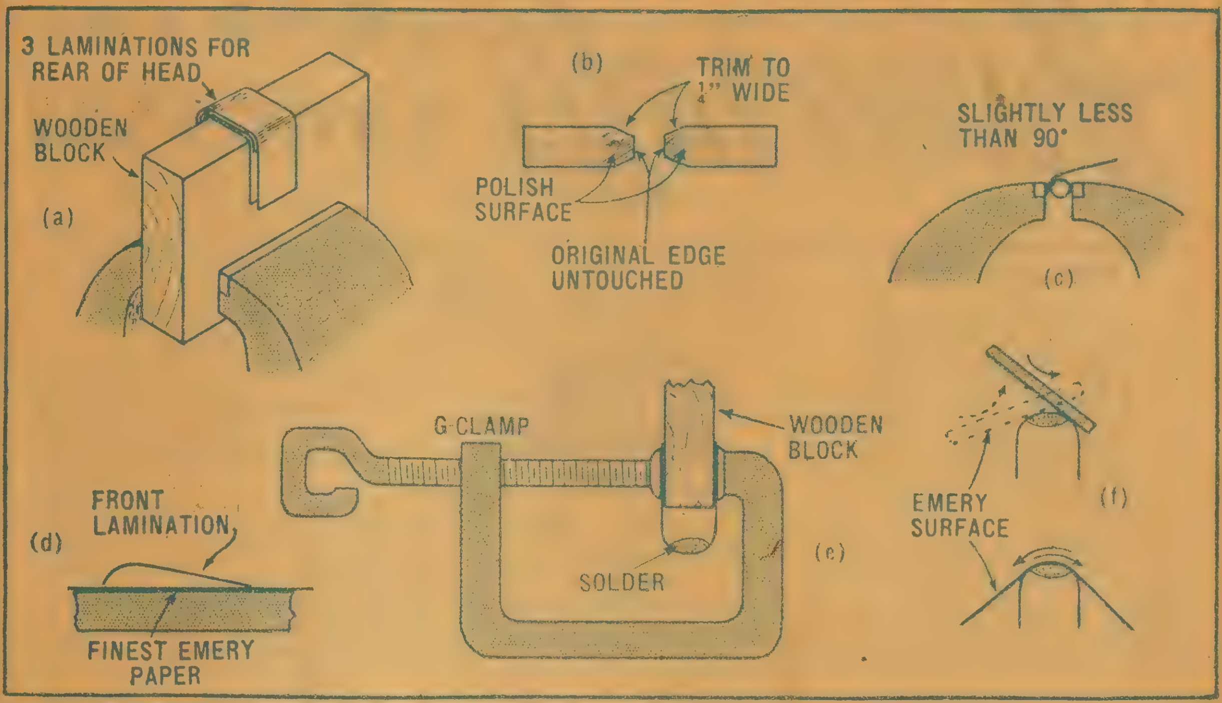

Figure 4: This diagram illustrates the various steps in making the head shown in Figure 3. After assembling the gap (e), the surface must be ground smooth as at (f). Grinding reduces the thickness of the pole tips and allows the bias field to penetrate the tape for recording. Without sufficient grinding the distortion level will be high.

only make the gap "real fine" and hope that the head will do a reasonable job for both record and playback.

Erase heads need a much larger gap, something of the order of .005in and present fewer difficulties, since an ordinary piece of brass shim can be inserted between the faces.

As far as materials are concerned for the laminations, the home-builder has two possible choices:

(1) So-called "stalloy", supplied in various grades and commonly used for power and audio transformers. The surface finish is usually a coarse grey, flaky coating.

(2) High permeability materials, of which the best known is "mumetal". It is usually lacquered blue or supplied with a smooth surface, rather like stainless steel in appearance.

HARD TO GET

Mumetal is difficult to obtain ta present in any quantity, but you may be able to obtain oddment transformer laminations from various sources at the cost of a few pence per lamination.

A few disposals transformers have appeared from time to time with mumetal laminations, while one occasionally comes across CRO tube shields, &c., made of the same material.

If you have any ideas about making your own heads, a few scraps of mumetal are essential for best results, although you can well "get your hand in" with the more plentiful materials.

In commercial circles, the normal practice is to stamp the laminations to size, then have the mumetal heat treated just before final assembly. This is done to realise its best magnetic properties. After heat treatment, those handling the material take care to avoid hitting or bending it and do not subject the completed unit to direct current through the windings.

In the face of this, it seems like tempting fate to suggest bending and filing scraps of mumetal in the attempt to build a magnetic head, and it is certainly not likely that home constructors will have access to a hydrogen furnace to heat treat the laminations after working on them.

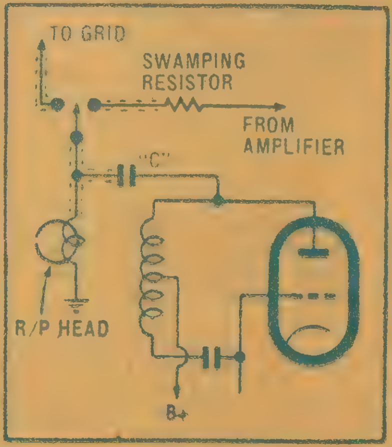

Figure 5: Conventional parallel feed to the head for signal and bias voltages. Condenser "C" must be kept small (preferably less than .001 mfd.) and the impedance of the head suitably low to prevent undue loss of high frequencies during both record and playback.

Be that as it may, we have built several mumetal heads along the lines described and had them work out successfully. Your experience will probably be the same. The actual method of construction is simple enough and does not call for any elaborate facilities.

Assuming that you have located a couple of suitable earphone bobbins, lay them side by side and measure the exact distance between the inner surfaces of the two windows. Select a scrap of hard wood or something similar, which is as thick as this dimension or very slightly thicker. Over this you will form your rear laminations as indicated in figure 4a.

The laminations will need to be just wide enough to slip through the bobbin and the two "legs" long enough to pass right through. You will have to estimate beforehand the size of the strips needed and cut them from your stock of mumetal scrap. Clamp them in the vice and reduce them to size with a fine cut file, using the jaws of the vice to keep them square.

REAR LAMINATIONS

Rough edges left by the filing can be cleaned up by rubbing the laminations on a fine grade of emery paper.

This done, bend them over the selected block of wood, as in 4a. You may be able to use a G-clamp or other devices to help get the bend sharp—but avoid hammering!

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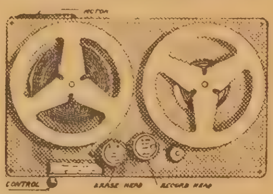

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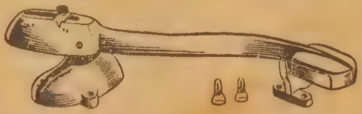

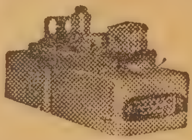

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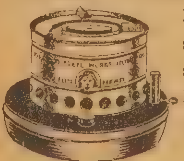

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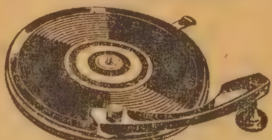

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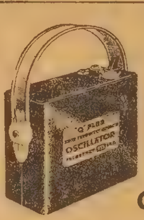

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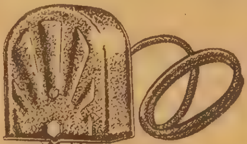

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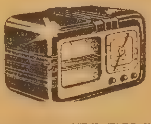

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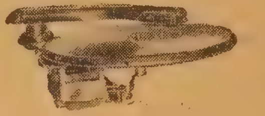

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Now extract the centre lamination and trim off all but about 1-8th inch of the legs. Dress the edges square with a fine file and emery paper.

Re-assembled, the three rear laminations should slip smoothly into the bobbins. The front lamination carrying the gap will ultimately slip into the space originally occupied by the legs of the centre lamination.

To form the gapped lamination, you will need two pieces of mumetal, which, when joined end to end, will slip right down into the respective bobbins and form a smooth arch for the active surface of the head. How far the arch protrudes, within reason, isn't critical.

Take two scraps of mumetal, dress them to the proper width to fit the bobbins, then taper the ends to slightly more than ¼in wide. The narrow ends will form the gap faces and it is wise to plan for them to be an original stamped edge.

Unless you have special facilities, it is likely that the original edge will be straighter and cleaner than you can manage by hand dressing.

READY FOR SOLDER

Polish one side of each lamination for about a quarter-inch back from the tip. This will allow it to take solder readily a little later on.

Now grip the narrow end of each lamination in turn between the very tip of the vice jaw and a piece of quarter-inch round metal. Keeping everything exactly square with the vice jaws, bend the metal around to slightly less than a right angle.

This done, place the lamination on a piece of fine emery paper and rub it sufficiently to bevel the rear edge of the gap. Remove approximately a quarter of the gap face in this way, leaving the original surface of the gap strictly alone.

At this stage you can aim for a very fine gap or a somewhat wider one, which is easier to work with. A successful head can be made either way.

For a fine gap, the idea is simply to butt the two edges together, taking care not to polish them beforehand. You simply rely on a lacquer film and/or natural chemical fouling to ensure a small but effective gap.

Alternatively, you may be able to obtain a scrap of the finest brass shim. Aluminium foil is no good because it melts when you try to solder the laminations together. We quite successfully used a scrap of cigarette paper for one particular head. You will probably end up with a whole array of gaps.

A head with a slightly oversize gap is always easier to get going than one with a fine gap, because it requires less high frequency bias. However, the ultimate reproduction will be somewhat lacking in high note response.

CAREFUL ADJUSTMENT

Now comes the ticklish job. Select a scrap of wood, slightly wider than your original form (4a), and clamp the two laminations as shown in 4e. Make certain that the gap faces are held together under slight spring pressure and that the outer surfaces are absolutely true with one another.

TWO TYPICAL HEAD ASSEMBLIES

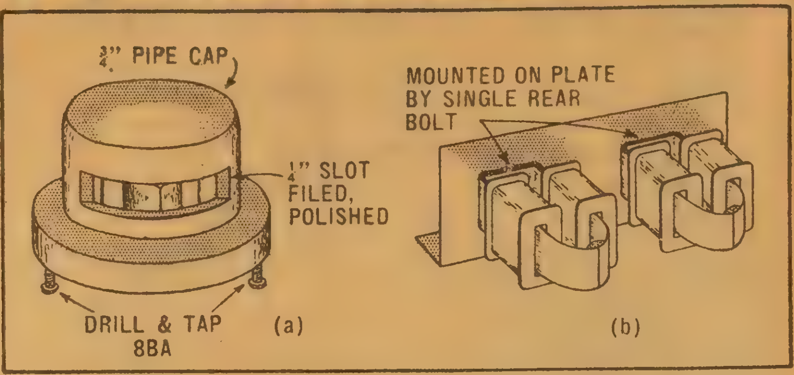

Figure 7: Two successful methods of mounting the finished heads. For half-track work one side of the gap assembly would have to be ground away and the space built up with brass strip to provide a running surface for the tape.

This done, turn the whole thing upside down and, using a good flux and a hot iron, flow in a big blob of solder. When set, remove from the clamp and wash thoroughly in petrol. To make the gap fit the space in the bobbins, you may have to do a little prudent bending with long-nosed pliers, being careful not to place a strain on the soldered joint.

The last operation is to polish the gap face and this will involve clamping it in some suitable fashion so that you can work freely on the surface. Rough it down with very fine emery cemented to a flat piece of wood. Keep the wood level and work over the surface with a rocking motion. The gap should gradually become an almost imperceptible line in the polished surface.

Finish it off with a strip of very fine and very worn emery paper to bring up a virtual mirror finish. This done, and the gap is ready to slip into position.

Make sure it fits properly, but don't take it for granted that the job is finished. It may be necessary later to slip the gap out again and thin down the metal a little more if the head distorts on record, despite all adjustments to the bias and windings.

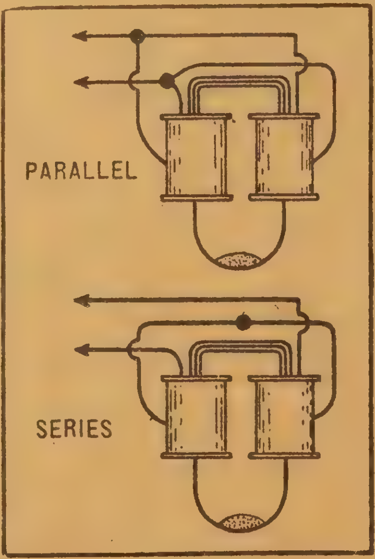

Figure 6: Connecting windings in series give more effective turns and higher output on playback. Successful recording, however, generally requires lower overall impedance and the parallel connection is usually better with bobbins of over 400ohm resistance.

Now for a word about the bobbins. We started off with the vague impression that there were two popular kinds of earphones — high impedance and low impedance. Their respective resistance per bobbin would be 500 ohms and 100 ohms, making 2000 and 400 ohms respectively for four bobbins connected in series.

A few inquiries established that there were many more popular varieties than this and that it would be necessary to give general hints rather than talk about two specific kinds of bobbin.

The highest impedance bobbins contain about 4500 turns of 42 B & S gauge wire, giving a measured resistance of just under 900 ohms.

The more common 2000-ohm phones are likely to contain four 500-ohm bobbins, each with something like 3000 turns of 41 B & S gauge.

So it goes on through other varieties — fewer turns but heavier wire — down to 45-ohm bobbins, wound with 1000-odd turns of 36 B & S.

For playback only, you get lots of output by having two 500-ohm bobbins connected in series, giving a total of 6000 active turns on the head. Our results with a head like this, playing back a piece of pre-recorded tape, were most encouraging, but we had certain lessons to learn.

TROUBLE WITH DISTORTION

When we tried to use the same head for recording, the distortion was atrocious and no amount of fiddling with the bias would cure it. The apparent reasons for this gradually became obvious.

While lots of turns mean good audio sensitivity, it also means a lot of inductive reactance at the bias frequency. As a result, the bias current is limited and, with it, the magnetising flux across the gap. The fact that there may be a lot of capacitive shunting and that you may also have achieved a fairly fine gap serves only to make matters worse.

Since we couldn't conveniently increase the bias voltage available — it was already very high — we had to reduce the head impedance. This was achieved by connecting the wind-

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ings in parallel rather than in series. Immediately we did so, the head began to produce respectable recordings.

You will make life a lot easier if, to begin with, you can bump up the tuning condensers across the bias oscillator coil and bring the bias frequency down to the 25Kc region (rather than nearer 50Kc). It all helps to get the bias current up and ensure a reasonably clean recording to start with.

It will simplify your problems with erase also.

Once you have made things work and know where you are, you can raise the bias nearer the desirable 50Kc mark and have another go. A high bias frequency, high impedance windings and a deep gap all conspire to make the bias ineffective and produce hopeless distortion.

We ran up against another problem, too, which has probably unwittingly stumped many experimenters — that of feeding bias to the head. The normal feed arrangement to a single winding record/play head involves a circuit along the lines of figure 5.

Ideally, condenser "C" should resonate at the bias frequency with the inductance of the head (or heads) it is feeding. This ensures maximum peak voltage across the heads and a relatively low value for "C". It might typically be from 250 to 500 pf.

AUDIO SHUNT

If, however, the head is self-resonant below the bias frequency, the normal inclination is to push up the value of "C" to extreme limits to obtain enough bias across the head. As a result, condenser "C" becomes a substantial shunt for audio frequencies across the head, via the low resistance of the bias oscillator coil.

Values like .05 mfd. — actually specified in some circuits — must have a tragic effect on the treble response for both record and playback, since they are shunted like a drastic tone-control across the audio system.

Intermediate values, like .005 to .01 mfd. can cause a serious peak in the range, due to parallel resonance with the head. It can be serious enough to cause actual ringing effects.

If, on the other hand, the parallel resonance can be "steered" just above the normal cut-off of the head, it may produce a useful extension of the range.

There is one other point worthy of mention: Large coupling condensers can store a considerable amount of energy and the discharge, during a switching operation, will sometimes magnetise the head. The magnetisation may or may not be cleared by switching temporarily back to "Record". A magnetised head is characterised by reduced output and high noise level, on playback, especially.

A COMPROMISE

The simple lesson behind all this is that very high impedance windings are not likely to be very successful in heads intended for record/playback or record only. In the normal way, a compromise must be found which will allow successful connection to the bias oscillator, yet ensure sufficient output when used for playback.

This was achieved in our first head simply by connecting the windings in parallel rather than in series. If you have occasion to use similar bobbins (500 ohm types), you will probably have the same experience.

By contrast, bobbins having substantially lower impedance may well employ the series connection.

Whichever connection is used, the coils must obviously be correctly phased. If you can get a loop of prerecorded tape, the phase can be verified by playing back the tape, using one winding only. The second winding is then brought into circuit and the mode of connection rejected, which reduces the output.

If and when you get round to making an erase head, you will find it absolutely necessary to use bobbins of quite low impedance, certainly no more than the 45 ohm types mentioned earlier. Even then, you may have to connect them in parallel. If you have to wind the bobbins yourself, we suggest you try about 500 turns per bobbin, using wire that fills the space.

TYPICAL CONNECTIONS

To summarise the position:

(1) A head for playback only should have the finest possible gap and may use series-connected high resistance windings for maximum output voltage.

(2) A head for "record" only can have a gap up to about .001in wide, but generally needs to have lower overall impedance, either by connecting windings in parallel or by using series-connected windings of lower resistance.

(3) A record/playback head needs to have a moderately small gap (say .0005in), and windings, as for a record head.

(4) An erase head should have a relatively large gap (say .005in) and low impedance (45 ohm windings or lower) and be capable of series resonance with the coupling capacitor.

(5) Where separate record and playback heads are used, the gaps must be accurately aligned for best treble response. Alignment of the erase head need be approximate only.

STALLOY HEADS?

Finally, if you can't locate a piece of mu-metal, a workable head can be made from ordinary stalloy laminations. Try to obtain some from a modern audio transformer, however, or from a Disposals type 500-cycle power transformer. The iron is likely to be of better grade than found in mass-produced 50-cycle transformers.

Figure 7 shows two possible methods of mounting your head.

In (a), a standard ¾in water-pipe cap has been provided with a slot for the tape, slightly more than ¼in wide. The edges of the slot must be polished with fine emery to avoid marking the tape. The head face is arranged to protrude very slightly into the track, so that the tape will ride positively across the gap.

Earth the laminations to the cap, jam it in place with tissue paper packing, or, if you like, seal it in with paraffin wax. Get the gap as near vertical as possible, although fine adjustment may be obtained later by packing the head mounting as a whole.

Bring out both leads through a common shield braid. One lead will go through the switching system to the input grid, the other can earth somewhere near the pre-amplifier socket to minimise possible chassis currents.

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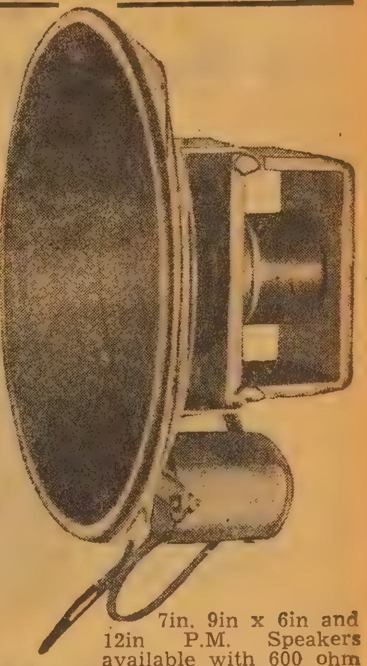
12in E.M., with TU transformer, 1500 ohm field.



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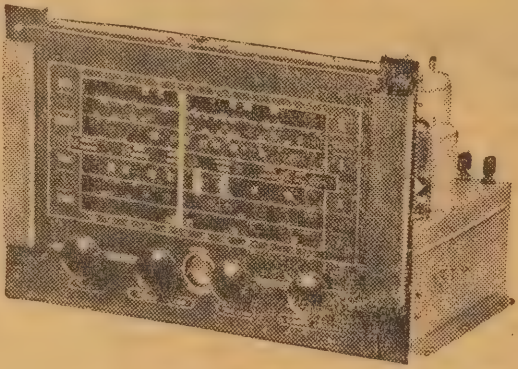

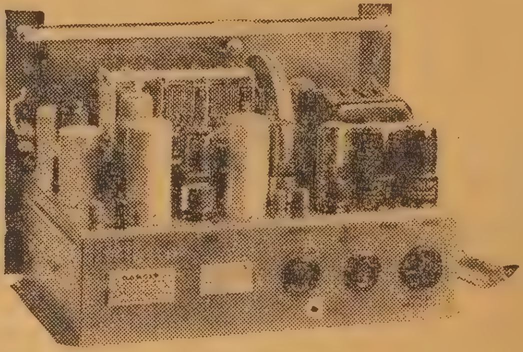

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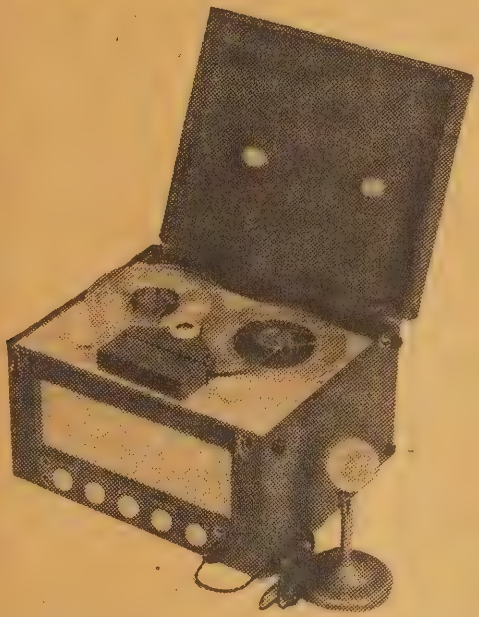

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LATEST METHODS OF ASSEMBLY

The present trend to miniaturised components and to stronger, more compact assemblies has led to the development of appropriate assembly methods, differing from the usual under-chassis wiring technique. Some of the methods are explained in this article.

UP till recently, the supply of miniaturised components was restricted largely to high priority undertakings, but the parts are now gradually becoming available to experimenters.

As a result, experimenters must learn the assembly techniques which, to date, have likewise been restricted in their application. The methods suggested are distinct from the printed circuit technique which has already been discussed.

One of the simplest devices for compact miniature construction is the turret-type tube socket, also called a socket turret.

As shown in Figure 1, there is attached under this socket a short length of insulating tubing (the "turret"), around which mounting lugs are fastened. Circuit components may be attached by means of their pigtail leads between these lugs and from lugs to the socket contacts.

FULLY WIRED

Complete amplifier, oscillator, and control circuits may be assembled around a tube in this fashion and can be installed or removed as units. The only external connections required are for the operating voltages and coupling between stages.

Socket turrets are available in the United States in miniature, as well as octal, types. While the socket turret is not a true sub-miniature component, its small size and the compactness it provides aid materially in reducing the dimensions of equipment which normally is spread over and under a chassis.

The small terminal board is a simple and straightforward supporting medium for circuit components in sub-miniature assemblies. Complete stages and circuits, as well, including small supply batteries, can be assembled on small boards or cards of this type.

This type of construction often is employed in hearing aids, test instruments, pocket radio receivers, and similar devices which do not employ printed circuits.

Figue 2 shows three representative types of terminal boards which can be made easily by the experimenter. Each uses a thin sheet of bakelite or fibre as the board.

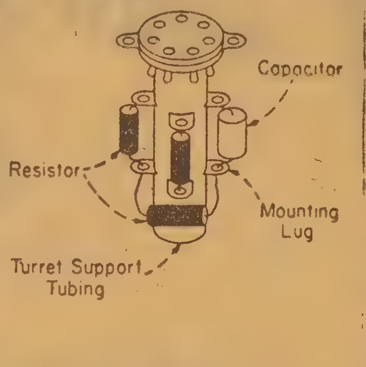
SOLDER LUGS

The first unit (Figure 2A) employs ordinary soldering lugs for terminals, and these are held in place by short machine screws and nuts. The lugs also could be rivetted in place, but most experimenters do not have the tools or machines to do this job.

Figure 2B shows a board made up with the popular turret-type pin terminals. Advantages of this style of terminal are its smaller size, rigidity and provision in each terminal pin of several grooves for attaching separate pigtails.

In general, it is easier to tie leads to and remove them from the turret terminal pins than from lugs. Turret-type terminal boards are available ready-made in several sizes and with various numbers of pins. The pins can be bought separately and fastened to an individual terminal board with simple tools.

The board shown in Figure 2C eliminates all lugs, pins, and other terminals, substituting pinholes through which the pigtail leads of the components are passed and drawn tightly. On the other side of the board, the leads may be interconnected, as required by the circuit, or attached to those of other components.



TURRET-SOCKET METHOD OF MOUNTING COMPONENTS

FIG. 1

This type of construction provides mechanical support for the components, as well as permitting a direct and easy method of wiring the circuit. Elimination of the protruding terminals usually found on a terminal board further reduces the space and weight totals of the assembly.

STRAPPED DOWN

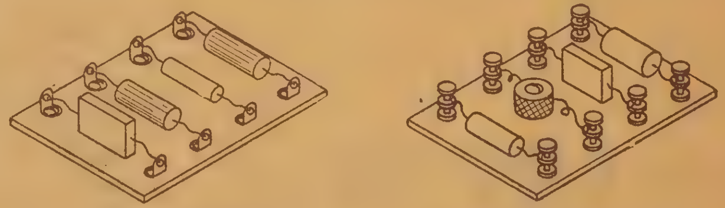
Using the "pinhole" terminal board, it is possible to build an entire unit of equipment (including several stages) using only the pigtails of components for mounting and wiring.

It is possible, at the same time, to obtain a tight construction. Single-end-mounted components, such as sub-miniature tubes, may be tied down by means of strap-clamps or clips.

Components may be mounted on both sides of any type of terminal board. The pins or lug-screws then may be utilised to carry connections through the board, or the leads themselves passing through the pinhole board may be attached directly to those of components on the reverse side of the board.

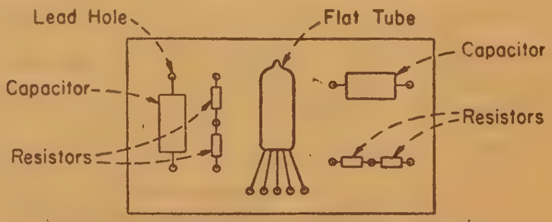
Board-assembled circuits subsequently may be encased or may be potted, as will be described later in this article.

The board-type sub-miniature assembly is compact and usually represents the smallest size and lightest weight attainable in a particular construction, short of printed circuitry.



(A) LUG-AND-SCREW TYPE

(B) TERMINAL POST TYPE



(C) SELF-SUPPORTING "LEAD-THRU-HOLE" TYPE

TERMINAL BOARD METHOD OF MOUNTING

FIG. 2

It has a slight disadvantage, however, that components sometimes are not easily removable by unsoldering when replacements must be made. This is true, particularly, of the pinhole type board and to a lesser extent of those boards using pins or lugs.

The mounting shown in Figure 3 is a solid block of some insulant, such as bakelite or other plastic, with holes or "wells" cut to hold capacitors, resistors, and other components. Lugs are attached also to the sides of the block for the attachment of external components.

Well-blocks of this sort are used in some multimeters to contain the multiplier and shunt resistors.

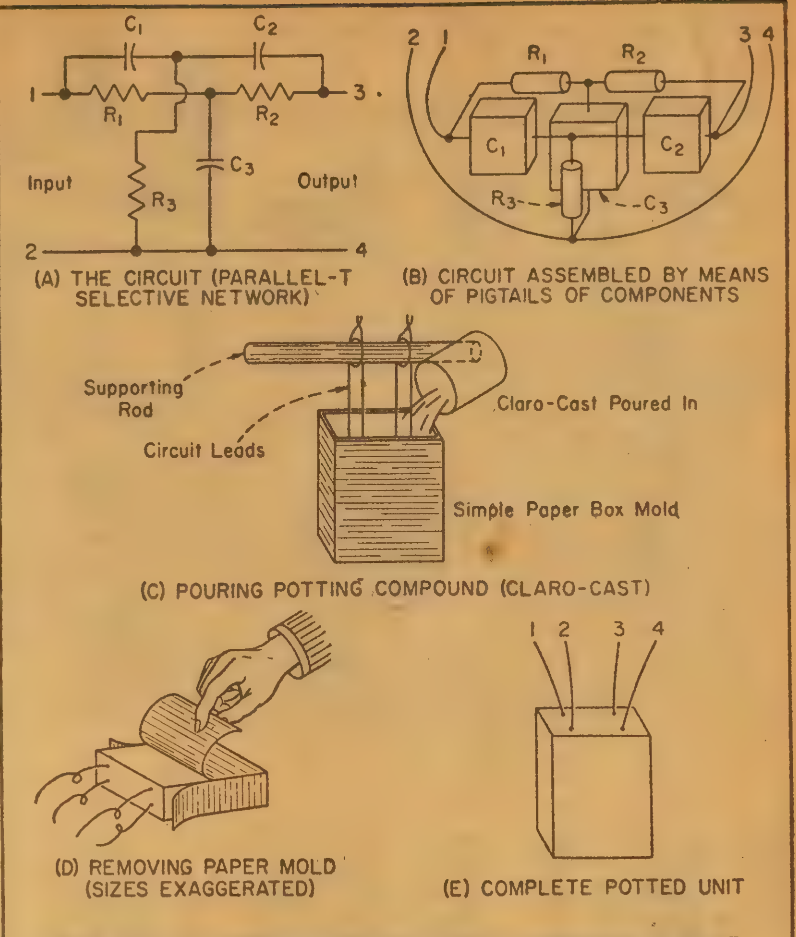
After wiring is completed, panels may be attached to the top and bottom of the structure to enclose the components completely.

The well-block has the advantages of solidity and rigidity. However, components such as heated tubes and resistors, which require the free circulation of air for cooling cannot be placed in the wells.

Component combination refers to associating two or more components intimately in a mechanical construction, in order to conserve space. Examples are: a coil wound on the insulating body of a resistor, a trimmer capacitor mounted inside a coil form, a coil wound around the glass envelope of a vacuum tube, and a shunt resistance element painted on the bakelite case of a capacitor.

This technique is an invaluable aid to subminiaturisation when it does not degrade the electrical performance of the circuit.

Whether component combination can be employed successfully depends upon the pertinent factors in an individual case.



(A) THE CIRCUIT (PARALLEL-T SELECTIVE NETWORK)

(B) CIRCUIT ASSEMBLED BY MEANS OF PIGTAILS OF COMPONENTS

(C) POURING POTTING COMPOUND (CLARO-CAST)

(D) REMOVING PAPER MOLD (SIZES EXAGGERATED)

(E) COMPLETE POTTED UNIT

STEP-BY-STEP PROCEDURE IN PLOTTING SUBMINIATURE CIRCUIT

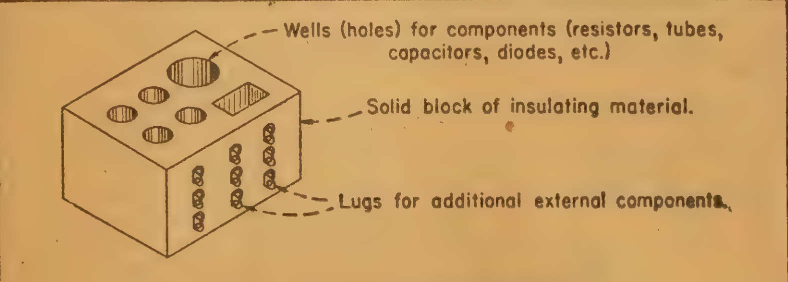
FIG. 4

AFFECTS "Q"

For example, the Q of a coil is lowered by conducting components within its field. Thus, the advisability of mounting a trimmer capacitor inside a coil form depends upon how much Q reduction can be tolerated in the coil. The same applies to a resistor made to function as a coil form.

A coil wound on the glass envelope of a vacuum tube might have its characteristics altered not only by the presence of the metallic electrodes of the tube within its magnetic field, but also by heating from the tube.

Before undertaking component combination, it is advisable to make actual tests of the effects upon electrical characteristics of one component by the proximity of the other. In this way, the feasibility of the combination may be established, or a more efficient way of mechanically combining the components devised.


Wells (holes) for components (resistors, tubes, capacitors, diodes, etc.)
Solid block of insulating material.
Lugs for additional external components.

WELL-BLOCK MOUNTING SCHEME

FIG. 3

Aside from the chance of altering electrical characteristics (principally capacitance, inductance and Q) in combining components, the greatest interference perhaps arises from heat.

A coil, capacitor, diode, transistor or thermistor will, unless it is suitably temperature-compensated, exhibit instability when closely associated with a hot resistor or tube. And the addition of correct compensating devices often defeats the original purpose of size reduction.

A technique which has found wide acceptance in commercial subminiaturisation is that of potting. This refers to the practice of casting the component assemblies into a solid block or capsule of insulating material.

The end result is a compact, neat and rigid assembly which resists mechanical and electrical disturbance. Large-scale potting of subminiature circuitry is found in the radar and guided missile fields.

There are many materials and methods of potting. Some are older than radio itself, but have been employed for some time. Well-known examples are the potting in waxes of transformers, chokes, capacitors and similar components.

WEIGHT AND COST

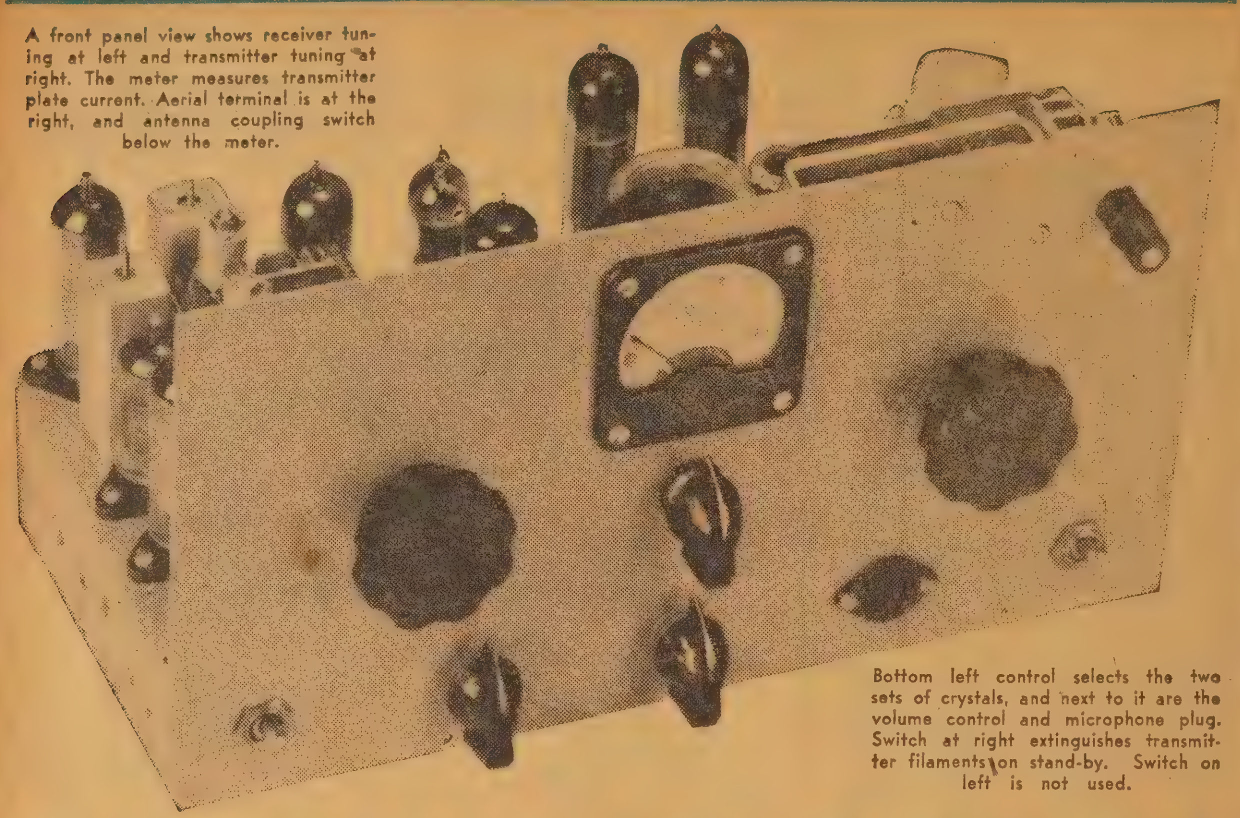
Although casting of multiple components has many advantages, its full usage in the electronic industry is retarded by certain drawbacks. These include the additional weight, higher cost and the fact that the failure of one potted component necessitates the discarding of the entire cast assembly.

The modern media for potting subminiature electronic circuits are "polymerising" synthetic resins which "cure" from a liquid to a rigid solid with or without the application of cast.

There are many casting materials (aside from coil dope, which does not set up quickly and satisfactorily) which can be handled by the amateur.

A popular one in the electronic industry is an epoxy type casting resin which sets up at resin tempera-

(Continued on Page 101)



A front panel view shows receiver tuning at left and transmitter tuning at right. The meter measures transmitter plate current. Aerial terminal is at the right, and antenna coupling switch below the meter.

Bottom left control selects the two sets of crystals, and next to it are the volume control and microphone plug. Switch at right extinguishes transmitter filaments on stand-by. Switch on left is not used.

2-WAY RADIO FOR BUSHFIRES

This receiver-transmitter should be ideal for bushfire work, small ships, and amateur operation. Both receiver and transmitter may be crystal controlled on two frequencies between 2 and 8 Mc and the power may be doubled by adding two valves and minor circuit changes. It works equally well from a vibrator or AC power supply. This article describes the basic design, and it will be followed next month with an article on aerial and supplementary data.

by John Moyle

IN last month's issue, we published an article dealing with the general problem of radio communication for bushfire fighting, the frequencies allotted for it, the type of equipment likely to be suitable, and a method of organising a network.

In this issue, as promised, we turn our attention to the design of equipment considered suitable for this work, and for any other type of communication (such as for small ships) using frequencies in the high frequency band between about 2 and 8 Mc.

THE REQUIREMENTS

Briefly re-stating the requirements, we want transmission and reception between mobile vehicles operating at the scene of the fire, and from at least one of these back to an administrative centre—probably a large town—in which there will also be a transmitter and receiver.

The equipment will operate on frequencies specifically nominated by the PMG Department, and can therefore use crystals to lock the tuning of both transmitters and receivers.

As there is also a special frequency set aside for inter-shire communication, the "base" station must also be capable of receiving and transmitting on this second frequency which is 2784 Kc.

The mobile sets must operate from 6 or 12 volt batteries, and use if possible both whip and fixed aerials as required. They must have the minimum of controls—preferably no more than a push-to-talk switch and a volume control.

The base station must operate from AC mains, and may therefore radiate higher power. Better aerials can be erected at these fixed locations.

All the equipment must be simple to build, small in size, and use standard components.

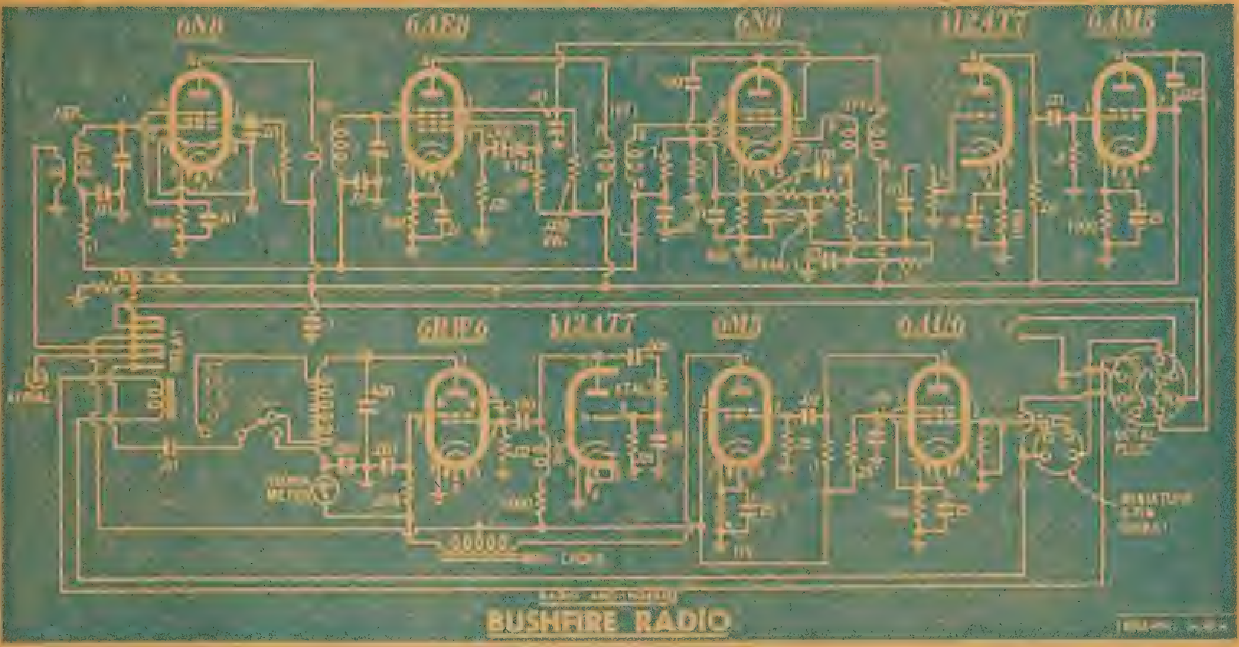
If possible, the same design should be suitable for either the base or a mobile station, thus standardising on parts and metal work.

In principle, all this is reasonably straightforward, but the selection of circuits and layouts has given us a great deal of thought. As with many such problems, there are many different methods of achieving the same result. Half a dozen designers could come up with half a dozen different answers, all of which could be good.

At the outset, therefore, we would not say that ours is the only answer. But it has grown out of personal experience with equipment of this type, from an inspection of the work of others, and from talks with men who have operated similar sets for bushfire and other purposes. As far as we can see, it incorporates all the major requirements we have had put to us, and includes some others we thought up ourselves.

It will be realised from the state-

CIRCUIT DIAGRAM OF BUSHFIRE EQUIPMENT



Here is the circuit showing crystal control of the receiver—for simplicity only one crystal is included. Output plug wiring has been arranged for both battery and AC power supplies. For higher power, the PA screen, grid, and modulator bias resistor values are halved. The 7500 ohm bleed resistor is NOT used with the vibrator supply.

ment of what is wanted that the gear will vary in complexity according to the part it must play. The mobile equipment for instance needs only one frequency channel—the base station must provide for two. Some base station operators like to have a tuneable receiver rather than one using two crystal locked channels. The base station should with little alteration be able to operate on higher power than a mobile, and so on.

COMPREHENSIVE CIRCUIT

Our equipment has been built in such a way that by including or omitting various features, all of which have been provided for in the circuit, it can be made to do all the necessary jobs without major alterations to layout or the need for a different chassis. This is important in standardising work for the chassis maker, and also for the constructor.

For instance the chassis allows the receiver to be built with normal gang condenser tuning, or with crystal control on one or two frequencies. There is room for a two-inch meter, either to read transmitter current or perhaps signal strength. There is room for a switch to change crystal frequencies for both receiver and transmitter.

This policy makes for the greatest flexibility in construction and use.

Because the adding or subtracting of such features will affect the holes needed in the front panel, and because no one likes unused holes staring them in the face, we are specifying a blank panel for the transmitter-receiver. But by building the first model with "everything up", we know you will have room for everything should you so desire, or wish to expand a mobile set into a more elaborate one.

BLUEPRINT AVAILABLE

We are preparing blue-prints for both chassis and panels which can be obtained through our query service, and these will show the positions we used for everything included in the photographs.

There are two power supplies built on chassis the same size as that used for the transmitter-receiver. One operates from a 6 or 12 volt supply, and the other from the AC mains.

PHOTOS AVAILABLE

GLAZED prints of the photographs shown in this issue may be ordered from us if you would like to have clearer pictures. The cost of 6 x 8 prints is 4/- each plus postage. Blueprints are also being prepared. Complete chassis prints including vibrator supply box will occupy two sheets at 4/6d each.

Each power supply includes a five-inch loud speaker, so that the addition of either to the main chassis makes up a complete station. Socket connections have been rationalised and two supplies are virtually interchangeable.

A hand microphone is used in both instances, and it's built-in switch is used to change from transmit to receive.

Unfortunately it isn't possible in one issue to deal with every aspect and version of the design, including aerial systems. In this article, therefore, we will give a full picture of the design with all features included. Next month we will show pictures of the equipment as it would be built for a mobile set on a single locked frequency, as a base station with two locked frequencies, a base station with a tunable receiver, and so on. In this way we will be able to present the clearest possible picture.

PHOTOGRAPHS

We are arranging to make actual photographs of the equipment in all these stages available for sale through our feature service and these will help you much more effectively than the printed versions which inevitably lose detail in processing.

The transmitter-receiver is built on a single chassis measuring 11 x 5½ x 1¾ inches. This is ½in deeper than the original to allow a little more mounting space particularly at the rear of the receiver, where things tend to become somewhat crowded. Our panel measured 11 x 6in, but if you use a wooden case, make the first dimension 11½in to provide a mounting flange at each side. We aimed at a compact construction without setting a task beyond the ability of any constructor with some experience of set building.

Discussing the receiver section first of all, this is located at the left-hand side of the chassis and consists of a standard 5-valve receiver designed to give good sensitivity and a moderate current drain.

The set uses an RF stage, a converter, one stage of IF at 455 Kc, a diode detector and noise limiter, a triode audio amplifier, and an output pentode.

TELEPHONES: JA2877, JA2878, JA5881 **FERGUSON LANE, CHATSWOOD**

STANDARD FERGUSON RANGE

RECEIVER POWER TRANSFORMERS

CODE NO	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS
PF185	240	150	30	6.3V/2A
PF299	240	285	40	6.3V/2A, 5V/2A
PF300	240	325	40	6.3V/2A, 5V/2A
PF201	240	225	50	6.3V/2A

NOTE: All transformers are available with upright mounting. The following 9 transformers are also available with flat mtg., fitted with an adaptor plate to suit 3 x 3½in centres. On removal of plate, mtg. centres become 2½ x 3 1-8in. IF flat mtg. is required afix Code No by letter F e.g. PF151F.

CODE NO	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS
PF151	230, 240	285	60	6.3V/2A, 5V/2A
PF166	230, 240	325	60	6.3V/2A, 5V/2A
PF165	230, 240	385	60	6.3V/2A, 5V/2A
PF170	230, 240	285	80	6.3V/2A, 6.3V/2A, 5V/2A
PF169	230, 240	325	80	6.3V/2A, 6.3V/2A, 5V/2A
PF168	230, 240	385	80	6.3V/2A, 6.3V/2A, 5V/2A
PF130	230, 240	285	100	6.3VCT/2A, 6.3V/2A, 5V/2A
PF164	230, 240	325	100	6.3VCT/2A, 6.3V/2A, 5V/2A
PF160	230, 240	385	100	6.3VCT/2.5A, 6.3V/2A, 5V/2A
PF152	230, 240	285	125	6.3VCT/3A, 6.3V/2A, 5V/2A
PF163	230, 240	325	125	6.3VCT/2.5A, 6.3V/2A, 5V/2A
PF181	230, 240	385	125	6.3VCT/3A, 6.3V/3A, 5V/2A
PF174	230, 240	285	150	6.3VCT/2A, 6.3V/2A, 5V/2A
PF142	230, 240	325	150	6.3VCT/2A, 6.3V/2A, 5V/3A
PF175	230, 240	385	150	6.3VCT/2A, 6.3V/2A, 5V/3A
PF167	230, 240	385	150	6.3VCT/2A, 5V/3A, 2.5VCT/5A
PF173	230, 240	425	175	6.3VCT/3A, 6.3V/2A, 5V/3A
PF140	230, 240	385	200	6.3VCT/3A, 6.3V/3A, 5V/3A
PF171	230, 240	385	250	6.3VCT/4A, 6.3V/3A, 5V/3A

POWER AMP. AND LOW POWER T/MITTER UNITS

PF172	230, 240	500	200	6.3V/4A, 6.3V/3A, 5V/3A
PF143	230, 240	600 500	200	2.5V/5A, 2.5V/5A, 5.5V/.5A
PF147	200, 230 240, 260	1000 750 500	200 250 300	5.5V/.3A
PF179	230, 240	475	225	6.3VCT/4A, 6.3V/2A, 5V/3A
PF107	230, 240	585	250	6.3V/3A, 6.3V/2.5A, 5V/3A

C.R.O. TRANSFORMERS

PF188	240	350 one ext. 900	30 2.	6.3V/2A, 6.3V/1A 5V tap 4V/2A 4V tap 2.5V/2A
PF545	240	350 one ext. 1000	20 1	6.3V/3A, 6.3V/.6A, 4V tap 2.5/2A

TAPE-RECORDING TRANSFORMERS

PF642	230, 240	250	80	6.3V/3A, 5V/2A Low radiation
PF664	240	265	80	6.3V/3A, 5V/2A Low radiation

PHOTOFLASH TRANSFORMERS

HT119	200	4000 ½ wave		
HT131	240	1100 ½ wave		prim. also vib, 5.2 or 4V

POWER CHOKES

CODE NO	IND HY.	DC RES.	DC MA
CF100	50	1900	10
CF101	30	870	25
CF102	15	300	60
CF103	30	420	60
CF104	30	580	80
CF105	15	250	80
CF106	12	200	100
CF107	30	360	100
CF108	12	135	150
CF109	20	225	150
CF110	12	100	200
CF111	16	165	200

CODE NO.	IND HY.	DC RES.	DC MA
CF112	10	70	250
CF113	5/20	70	150/250
CF115	.017	.6	2A
CF119	.005	.1	6A
CF162	10	90	330
CF196	20	130	125

CF114*	40 watt fluor ballast
CF213*	20 watt fluor ballast

*Fitted with rubber mounting to reduce hum. Standard 5¼in hole centres.

VIBRATOR AND A.C. POWER TRANSFORMERS

CODE NO	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS
PF182	240AC 12VIB	200	40	12.6/1A
PF122	240AC 6VIB	220	40	6.3V/2A
PF125	240AC 6VIB	250	60	6.3V/2A
PF126	240AC 12VIB	250	60	12.6VCT/1A
PF119	240AC 6VIB	325	125	6.3V/4A
PF146	200, 230, 240 AC 12VIB	325	150	12.6VCT/2.5A

VIBRATOR TRANSFORMERS

CODE NO	PRIM VOLTS	DC Volts	O'put mA	Buffer Full Sec	
VT101	6	90	15	.008	
VT102	6	150	25	.005	
VT103	6	200	50	.005	
VT127	6	200	50	.005	Low radiation. Car Radios
VT104	6	250	60	.005	
VT107	6	250	60	.005	Low radiation. Car Radios
VT106	6	300	75	.008	
VT122	6	400	50	.005	
VT146	12 or 6	240AC	50w	IMFD	For Emergency light, etc.
VT112	12	200	50	.005	
VT132	12	200	60	.005	Low radiation. Car Radios
VT105	12	250	60	.005	
VT117	12	250	60	.005	Low radiation. Car Radios
VT114	12	300	75	.008	
VT123	12	320	125	.005	
VT113	24	200	50	.005	
VT116	24	250	60	.005	
VT115	24	300	75	.008	
VT119	32	150	25	.005	
VT100	32	200	40	.005	
VT124	32	250	60	.005	

FILAMENT TRANSFORMERS

CODE NO	PRIMARY VOLTS	SEC. VOLTS
PF118	220, 240, 260	2.5V/5A, 2.5V/5A
PF158	220, 240, 260	5V/8A
PF476	240	6.3V/3A
PF138	220, 240	6.3V/4A, 5V/4A, 2.5V/4A, 2.5V/4A
PF162	240	6.3V/3A, 6.3V/3A
PF154	200, 230, 240	7V tap 6V/7A, 6.3V/3A, 5VCT/5A 5V/3A, 2.5V/7A
PF102	240	7.5V/2A
PF111	240	10V/5A
PF211	200, 230, 240	10VCT/10A
PF131	230, 240	10VCT/10A, 5V/15A
PF123	240	15, 12, 8, 6V/1.8A
PF439	240	32V 60W Enclosed one outlet
PF457	240	32V 125W Enclosed two outlets
PF491	240	32V 200 W Enclosed two outlets

BATTERY-CHARGING TRANSFORMERS

CODE NO	PRIMARY VOLTS	SEC. VOLTS
PF265	230, 240	17V tap 11.5, 10, 8.5/4.2A
PF389	230, 240	17, 11.5, 10, 8.5V/4.2A, 17, 11.5V/4.2A 17, 11.5V/4.2A
PF537	240	17V tap 11.5V/0.4A

BELL TRANSFORMERS

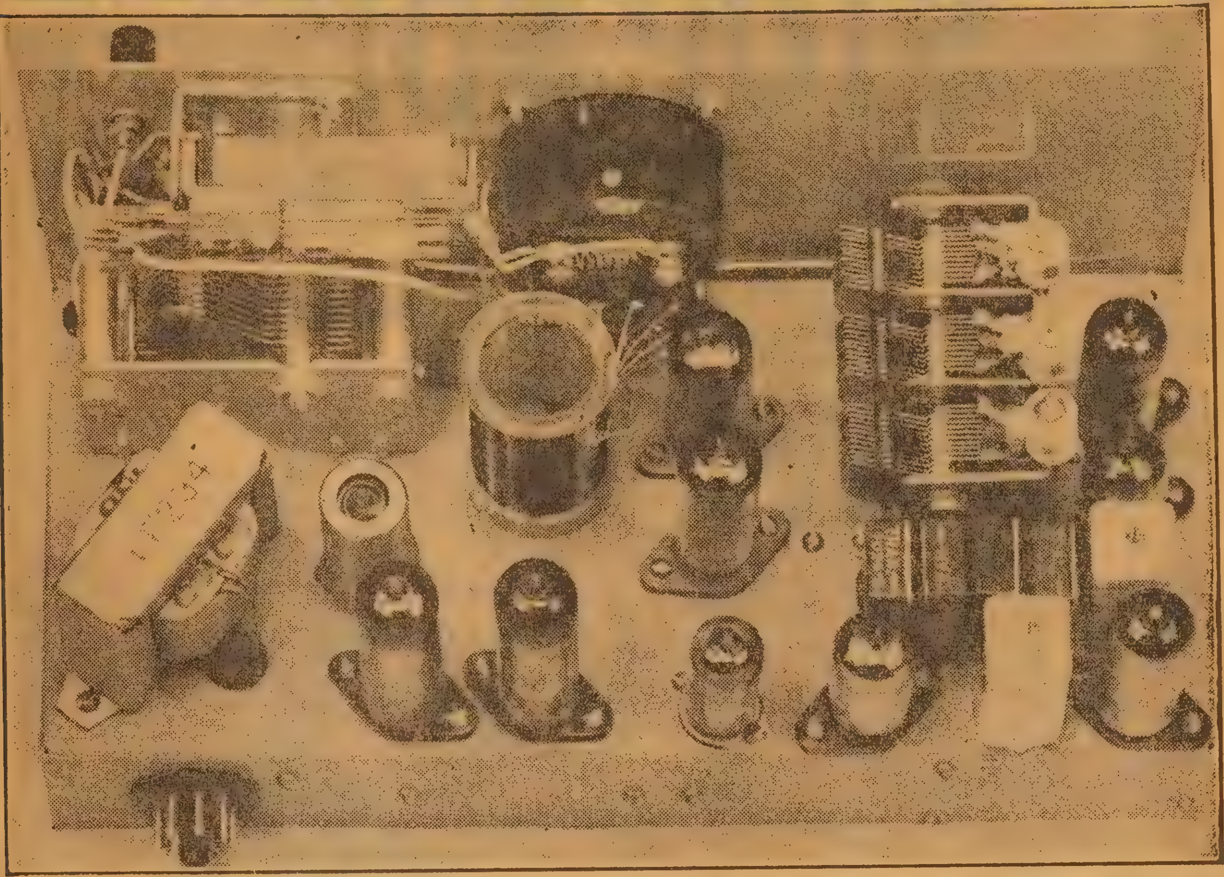
CODE NO	PRIMARY VOLTS	SEC. VOLTS
PF648	240	10W Continuous or 2A intermittent.

Fully enclosed including 240V socket and outlet terminals. Designed to operate local and imported chimes as well as various types of bells.

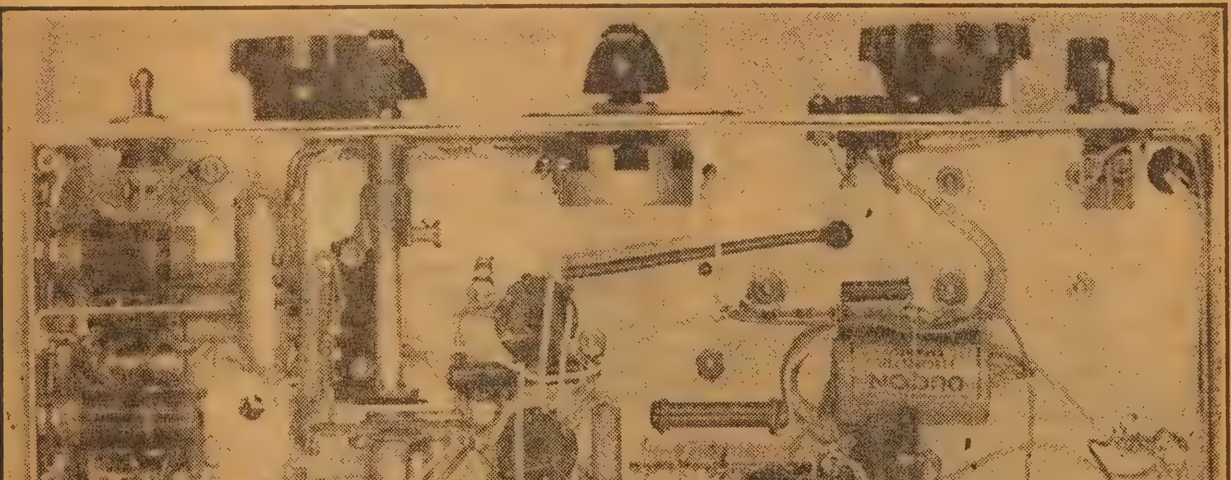
IN ADDITION TO THE ABOVE RANGE, A STANDARD RANGE OF OUTPUT AND MODULATION TRANSFORMERS IS AVAILABLE

ENGINEERED **TODAY** FOR **TOMORROW'S** REQUIREMENTS

TOP VIEW OF BUSHFIRE TRANSMITTER RECEIVER



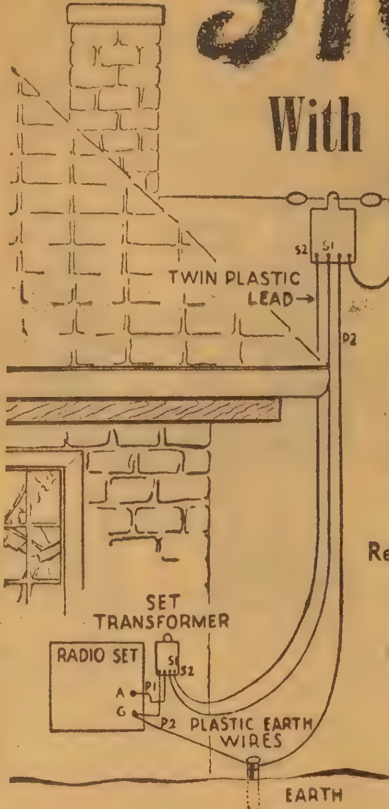
This top view shows the receiver at right, and transmitter at left. The two PA valves are next to the transmitter tank coil, and the modulator and preamplifier valves at bottom left. Note crystals behind the gang. Modulation choke is at extreme left behind it the transmitter tank tuning condenser, and above it the aerial change-over relay.



Under the chassis, the receiver wiring is grouped at the left. Note the Aerial and Mixer coils with their shield. An oscillator coil was not fitted to this receiver. Use miniature components, as there is not enough room for larger types. The chassis specified is ½inch deeper to give a little more room. The receiver voltage dropping resistor goes at the right but is not shown.

STOP NOISE IN YOUR SET

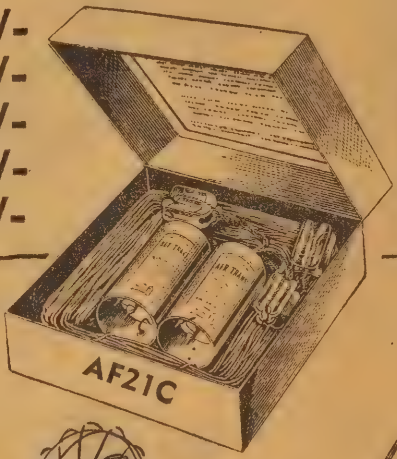
With R.C.S. aerial and line filters


S2
S1
P1
TWIN PLASTIC LEAD→
P2
SET TRANSFORMER
RADIO SET
A
G
S1
S2
P1
P2
PLASTIC EARTH WIRES
EARTH

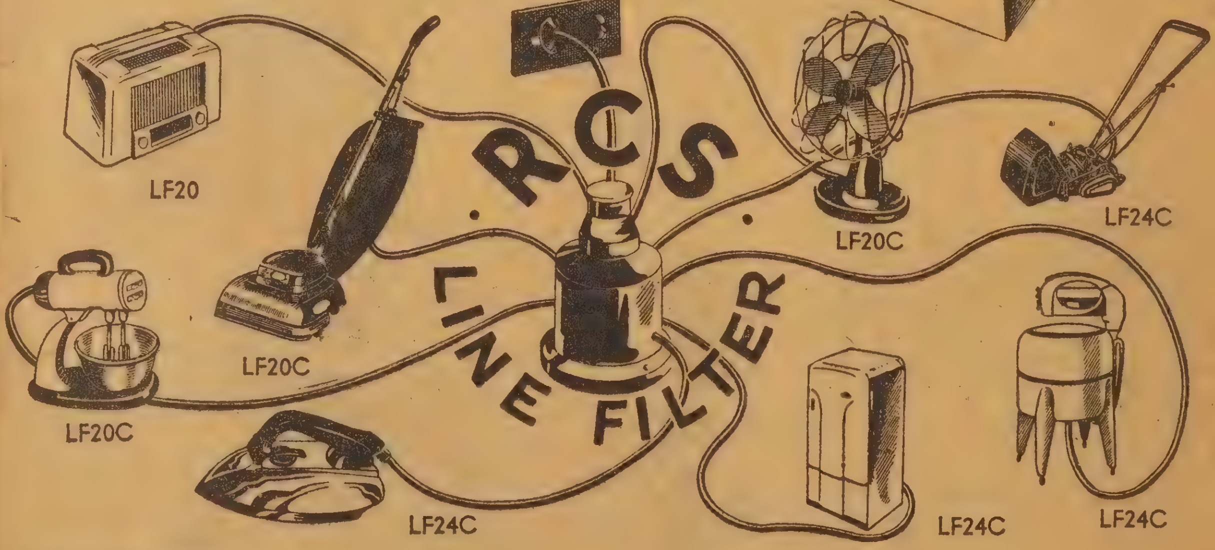
MAKE THIS SIMPLE TEST:—

1. Remove aerial from set. If the noise stops, you need an AF21C aerial filter, as the noise is coming through your aerial.
2. If the noise continues, you need an LF20 line filter as the noise is coming through your power main.
3. If any of the appliances shown below are causing the noise, then fit to it a line filter of the type shown.

Retail	AF21C aerial filter	140/-
"	LF20 line filter ..	37/-
"	LF20C " " ...	42/-
"	LF24 " "	50/-
"	LF24C " "	55/-



CONFINE NOISE WHERE IT STARTS — WITH R.C.S. LINE FILTER


LF20
LF20C
LF20C
LF24C
. R C S .
LINE FILTER
LF20C
LF24C
LF24C
LF24C
LF24C

DISTRIBUTORS:—

N.S.W. Bloch & Gerber—Fox & MacGillycuddy—U.R.D.—John Martin — Lawrence & Hansom — Homecrafts — Martin de Launay — Radio Despatch — Cooke Bros. —

W.A. Carlyle & Atkins

S.A. Gerard & Goodman.

VIC. R. E. Trickey—Homecrafts—Motor Spares—Radio Parts.

QLD. B. Martin & Irvine—Chandlers.

TAS. Homecrafts — W. G. Genders.

R. C. S. RADIO PTY. LTD.

651 FOREST ROAD,
BEXLEY. PHONE LW 3491

The tuning gang is a standard midget type—we used one with an inbuilt vernier movement to assist in fine tuning. Alternatively a simple vernier dial may be constructed from a 3in front mounting dial, and a control knob using a rubber tyre working against the dial rim, after the manner of some service equipment. Gadgets of this kind are often available from disposals.

TUNING GANG

The tuning gang will only be needed if the receiver is fully tuned. If crystal controlled on one frequency, there is no need for a tuning gang at all. Only the RF and mixer coils will be used, and these can be lined up with standard trimmers, their capacitance augmented if necessary by small mica condensers to tune them to the signal frequency.

An ordinary mounting strip can support them above the chassis in the space now occupied by the gang. Values will depend on the exact frequency allocated to your shire or brigade.

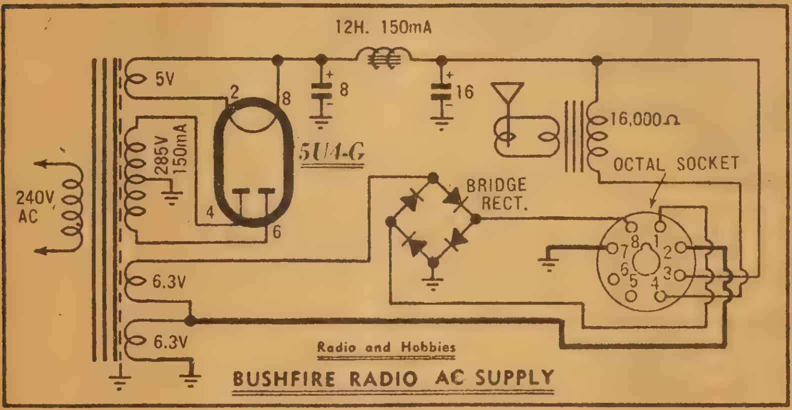
In the case of a base station with two crystal-locked frequencies, the coils must be tunable to both. The easiest way would be to use a two-gang midget, which costs a little less than a three-gang type, and use it to adjust tuning after the crystal frequency has been changed.

An elaboration of this idea would be to use a second section on the switch to bring in pre-tuned trimmers for each frequency, thus doing away with tuning altogether. Our layout will allow for many variations of this type.

The coils themselves are mounted under the chassis above the respective valve sockets, and are home-wound on ½in formers. In order to preserve best efficiency, we are working out two sets of data—one for the higher frequencies below about 4.5 Mc, and the other for those between 2 and 4.5 Mc.

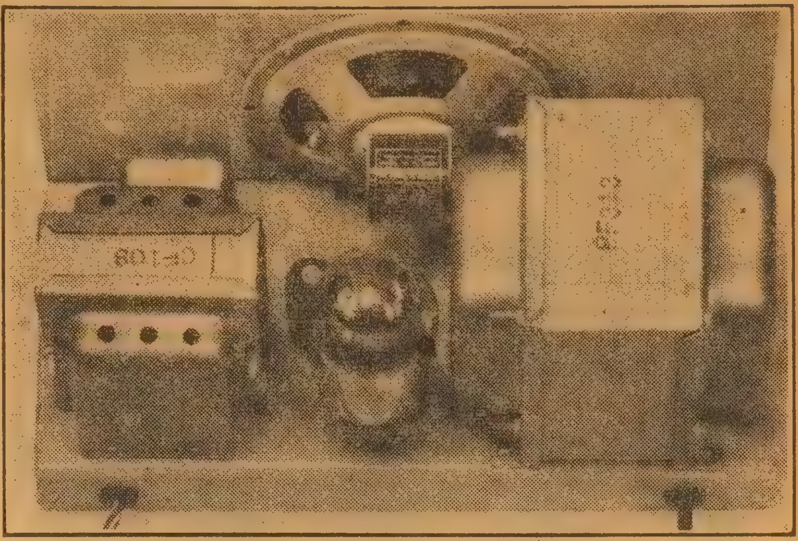
Both sets of coils must be padded up to reach the inter-shire frequency, and there will be a little loss in gain at 2784 Kc if the shire or brigade frequency is down near the 6 Mc end. This, however, is unavoidable, and because the base stations which use this special frequency will generally have good aerials and reasonable power, the loss isn't particularly important.

A small shield is mounted between the RF and mixer coils, and is best



The AC circuit is quite simple—only unusual point is the power connection for the relay rectifier.

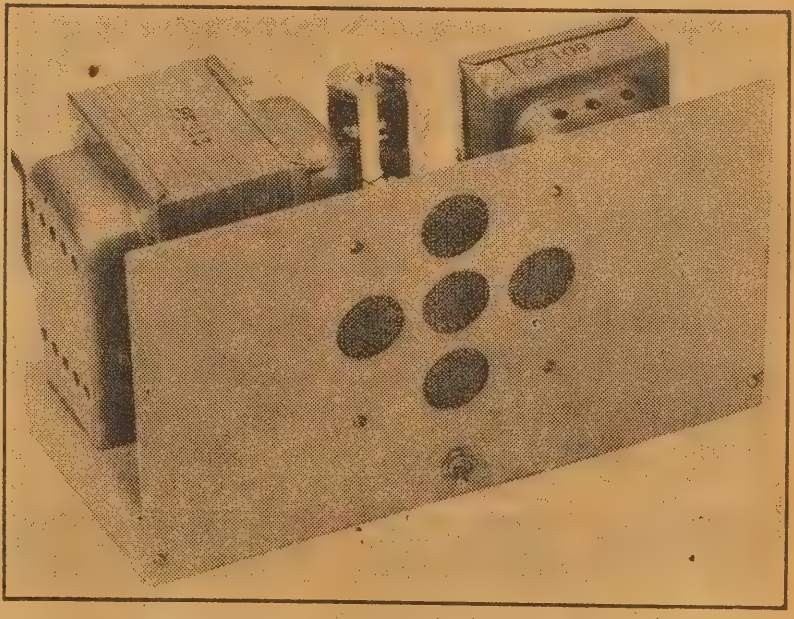
REAR VIEW OF A-C POWER SUPPLY



Here is the AC power supply from the rear. Note speaker mounting with its transformer immediately behind the choke at left. The telephone type rectifier for relay supply is seen at the side of the valve.

installed after the wiring has been completed.

The crystal sockets are located behind the tuning gang position. Provision is made for four crystals to accommodate the needs of the base station—two for the receiver and two for the transmitter. These are selected by a switch operated from the front panel, and both crystals are switched in the one movement. The leads to the switch are quite short. Best use the FT type crystals as their sockets are small. Larger crystals could be used by encroaching on the



A front view of the supply shows the mains switch below the speaker grille. Power transformer is somewhat larger than the type you will use.

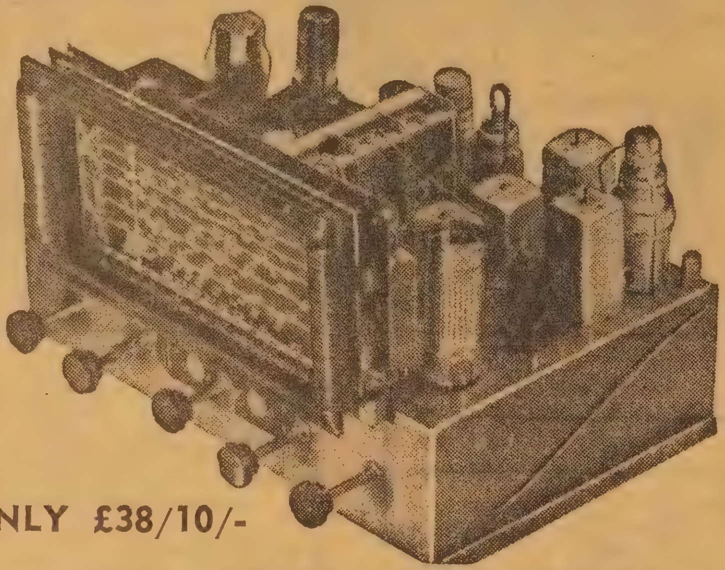
THE LATEST GEX MODEL CRYSTAL SET with Germanium permanent fixed crystal detector. In leatherette covered case, size 6in x 4in x 2½in, £4/6/9. Complete with headphones, £6/5/-.

Midget Crystal Set 57/6, Phones 38/4

1 valve mantel model radio in leatherette covered case 6¼in x 4½in x 5⅝in with headphones and batteries £7/16/-. Also available in a leatherette covered portable case 9in x 5in x 6in, £8/10/-.

2 valve mantel model radio in leatherette covered case 8in x 5¼in x 2¾in with 3½in speaker and batteries, £9/17/6, or in a leatherette covered portable case 9in x 5in x 6in, £10/10/-.

Ideal sets for use in hospitals or as a second set for household use. Battery life approximately 6-9 months. Replacement batteries 22/3 per set. Country clients please allow for freight.



ONLY £38/10/-

FOR THIS 8-VALVE DUAL WAVE RADIO

Here's value only to be found at Radio House Pty. Ltd. This readymade and tested chassis is complete with valves and 12in permagnetic speaker. Complete in every detail, it's easily fitted into your radio or radiogram cabinet and can be supplied with a polished wood front panel. Ideal for overseas reception, fitted with phono pick-up terminals, and has two separate tone controls for treble and bass boost. Size 16in x 10½in x 9in high.

SOUND AMPLIFIERS

For Phonograph Pick-up and Microphone

240 volt A.C. models complete ready for use (without cabinet, microphone or pick-up).

3 valve with 8in speaker, £12/17/6 (suitable for phono pick-up only, 3 watt output). 12in speaker £1 extra.

4 valve midget with 8in speaker, £13/15/- (suitable for phono pick-up and microphone 4 watt output). 12in speaker £1 extra.

5 valve with 12in speaker, £21/10/- (suitable for phono pick-up only, 8 watt output).

6 valve with 12in speaker, £25/-/- (suitable for phono pick-up and microphone 12 watt output).

SPECIAL MODELS MADE TO ORDER

6 volt battery-operated 3 valve and vibrator with 8in speaker, £18/10/- (suitable for phono pick-up and microphone 4 watt).

SPECIAL CUT-PRICE LINES AT GIVE-AWAY PRICES

Goldring Headmaster pick-up, £5. Reduced from £12/4/6.
Chassis 3⅝in x 3⅛in x 1⅞in, 1/6. Panel to suit, 6d.
Collaro phono motor and pick-up, 240v. A.C., £5/5/-. Reduced from £9/17/6.
1.4v Valves (3Q4), 2/6 each.
Combination Tool. 10in hammer, pincers, staple puller, 2 wire cutters, wire grips. Forged steel. German manufacture, 22/6. Reduced to 15/-.
Electron Aerial Wire—two 50ft coils 4/-.
Xmas Tree decoration lights, 59/6 set.
Swiss-made 240 volt A.C. record changers for 8 records—crystal pick-up, £12/7/6.
"Scope" electro-plating set. Plates nickel, copper, tin and zinc. 49/6. Gold, 15/9 or silver, 8/6 extra.
Wizard clip-on Lamp Holder Bracket with ball and socket swivel. All metal. Suitable for workshop or bedlamp, 7/6.
Shop-soiled Stromberg Carlson 3-speed Record Changers, £22/-/-.
English TELSEN 3ft 2-note Door Chimes, £3/9/6. Small Model, 42/6.
Pruning shears, 9in Polished Steel. Imported, 17/6. Reduced to 10/-.
Goldring Gramophone Soundbox Speakers 15/6. Reduced to 5/-.

All the above can be had by Mail Order, Freight Charges to be added.

RADIO HOUSE PTY. LTD.

296 PITT STREET, SYDNEY

space now occupied by the rear section of the three-gang, as you will probably use a two-gang type if crystal controlled.

CRYSTALS RECOMMENDED

We strongly recommend the use of crystals for the receiver. They prevent drift, eliminate incorrect tuning and guard against vibration altering the oscillator setting. Don't be afraid of the circuit if you have never used it—it is actually simpler than winding and tracking an oscillator coil.

The IF stage is quite standard. We have used the same type of valves for RF and IF sockets to reduce the number of types. The coils are standard 455 Kc midgets. The second 6N8 provides AVC for one of its diodes.

You will see that we have used a noise limiter as a fixture by wiring in a germanium diode. The noise limiter is of the greatest value in reducing ignition noise and static—two very serious enemies when signals are not strong. Again it is a simple and well-tried circuit, which can be wired and forgotten.

The audio amplifier uses one half of a 12AT7 double triode, and a 6AM5 output pentode. This latter is a much neglected valve, which needs only .2 amp filament drain, about 20 mills plate current, and gives 1.2 watts—enough for almost any use. It could be replaced quite easily with a 6M5, 6AQ5, &c., at the expense of higher drain and amended bias resistors. We used this valve to reduce current drain on stand-by.

We were tempted to include a muting circuit which quietens the receiver in the absence of a carrier and is useful to suppress noise during long standbys. Unfortunately, it would complicate the circuit quite a bit, and add further to the drain and number of valves, so in the interests of simplicity we left it out.

It would also call for an extra control, and there is always the danger of missing a signal too weak to operate it. After all, the set is for emergencies, and not something in use every day and all day.

Volume is controlled by the usual potentiometer on the front panel.

THE TRANSMITTER

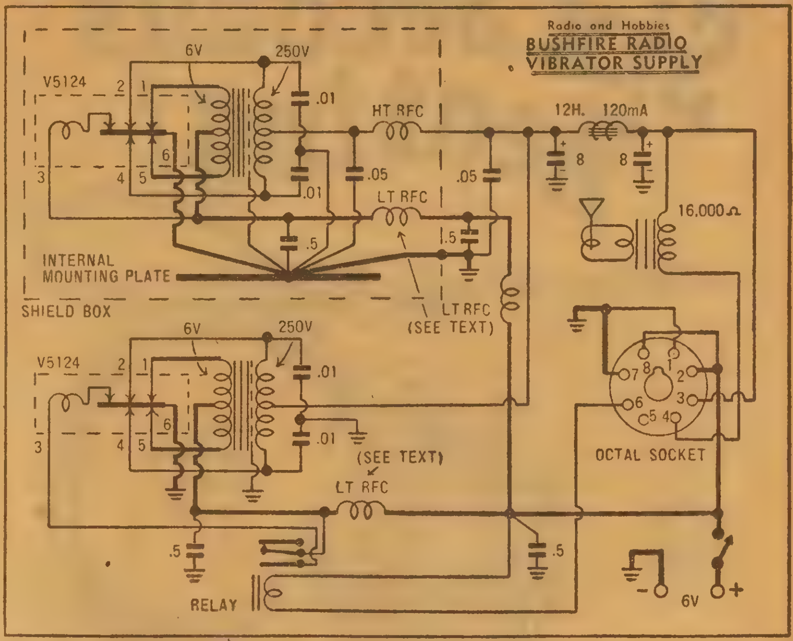
Turning now to the transmitter we have used essentially the same circuit as we employed recently for a small amateur transmitter, and which we have found exceptionally simple and effective.

It consists of a crystal oscillator using the second half of the 12AT7 in the receiver audio section. This valve has been placed so that it is close to the crystal sockets and switch, and to the power amplifier sockets as well. It is a Pierce oscillator which needs no tuning coil, and greatly simplifies the task of changing the transmitter frequency from one crystal to the other in the case of the base station equipment. The only tuning in the transmitter is carried out by the final tank condenser, which is an ordinary broadcast type—a full sized component to get the maximum condenser spacing.

For single frequency work, such as a mobile would require, this condenser can be adjusted in connection with its aerial, and not touched again—not even requiring a knob or dial on the front panel if you can lock it in place.

However, in case aerials need be changed. it is convenient to have a front panel adjustment. By wiring in a plate meter as we have done, it is a simple matter to tune the tank to resonance by watching the meter dip, thus being sure the transmitter is delivering maximum power at all times.

CIRCUIT OF VIBRATOR SUPPLY



The vibrator power circuit features twin units with a common filter. Black leads carry heavy current and should be of heavy gauge. Note single point earthing in shielded supply, and relay which switches in the reed current for the extra unit on transmission.

TANK COIL

The tank coil is wound on an ordinary short-wave plastic former, details of which will be given later. The aerial is connected by tapping it through a condenser to the coil at the spot which gives the correct loading. As all our aerials will be designed to similate quarter wavelengths, the same tap will probably do either for a whip aerial or a quarter wavelength of wire. In the case of the base station, half wavelengths of aerial will probably be used for better radiation. Here a coupling loop can probably be used.

The amplifier valve, which may be any type such as the 6M5, 6BW6, 6AQ5, &c., is plate modulated by a similar valve. We prefer the 6BW6 in the transmitter as being the most robust for this work, and the 6M5, which is more sensitive for the modulator. The 6BV7 is another high-GM valve which would do well in the modulator and possibly the transmitter.

As there is considerable divergence of opinion in the matter of microphones, we have included a pre-amplifier valve which will allow crystal types to be used. We like these microphones in the interests of intelligibility, although they are probably not as robust as the carbon types, and must not be left lying in the hot sun.

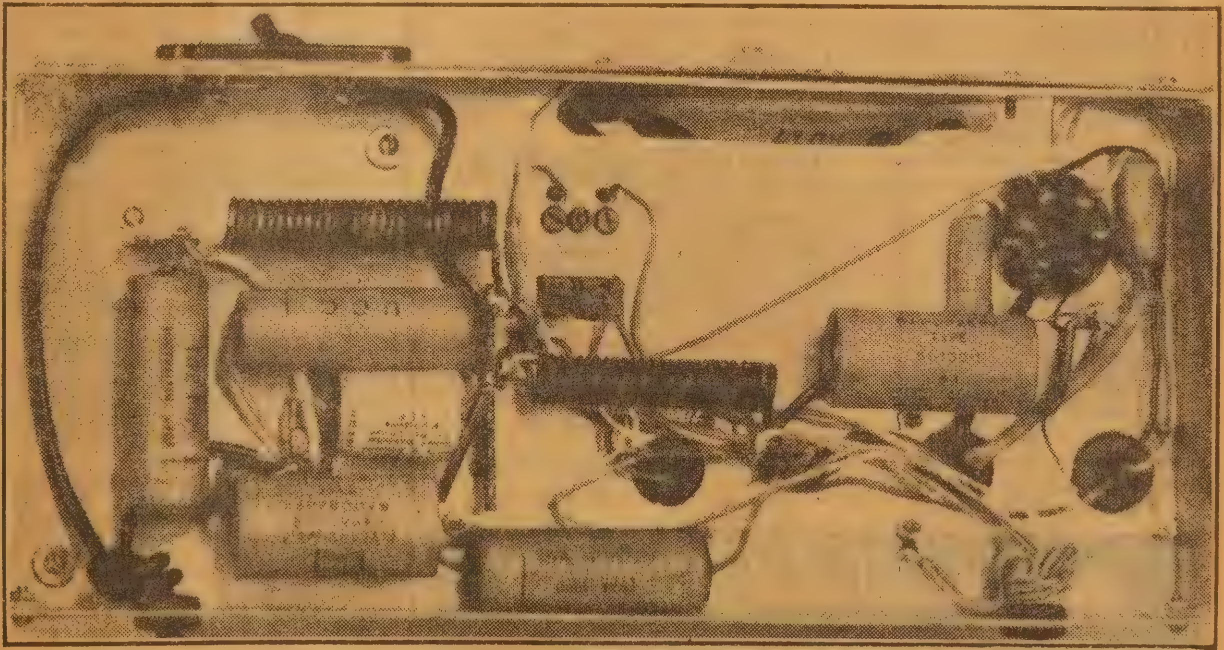
If you are one of those who are impressed by the case for the carbon mike, it is a simple matter to leave out this preamplifier, and connect the secondary of a microphone transformer direct to the grid of the modulator valve. Current for the microphone could then be taken from portion of the output valve's bias resistor—about 3 volts being enough. Or you could wire the 6AU6 as a triode and use it to couple the carbon mike which would be connected in the cathode circuit. Once again, the design is flexible on this point.

The most suitable crystal inserts would probably be one of the small deaf-aid types, although something better might be used for the base station. There is no need for a gain control in the microphone circuit.

Modulation is by means of a centre-tapped choke, the modulator feeding through one-half of the winding, and the PA through the other. As both valves draw approximately the same current, there is a high degree of cancellation in core saturation, and we can use a small component. We used an ordinary centre-tapped speaker transformer during experiments, although at least one manufacturer has made up a special choke for the purpose.

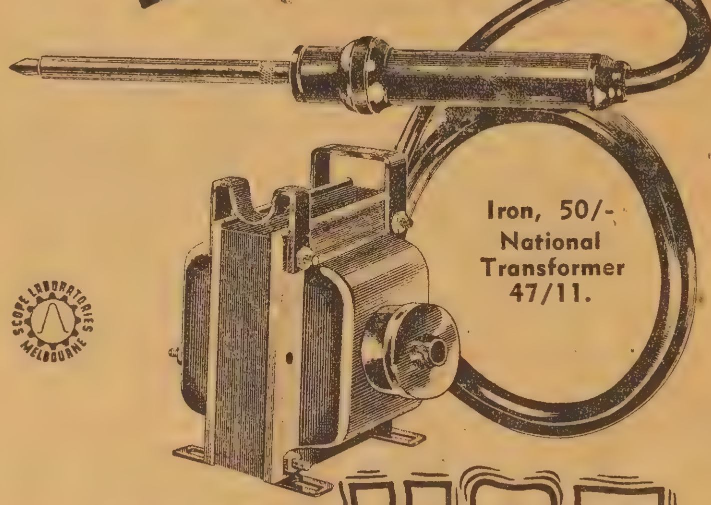
POWER INCREASE

This transmitter lends itself easily to an increase in power merely by



Under the main vibrator chassis. The two heavy filament chokes are visible. The relay is end-mounted so that the connections are made from beneath. It is in the centre of the chassis.

Six Seconds Heating!



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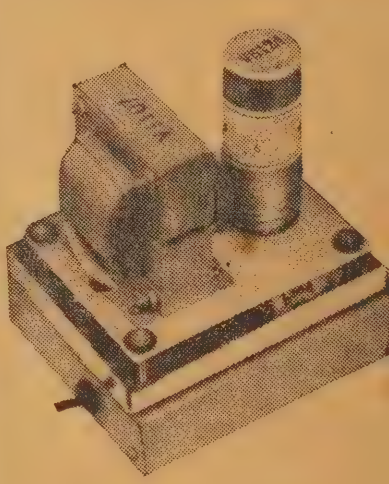
using an extra paralleled valve in both PA and modulator circuits. This is a procedure recommended for the base station, where the extra power is not an embarrassment to the power supply. The extra sockets are included in the layout, and are wired as pairs in parallel connection. The only circuit change is to halve the values of the PA grid resistor, the screen resistor, and the modulator bias resistor to take care of the extra load. The AC power supply has been designed to operate on an intermittent basis with such a connection.

A switch on the front panel douses the transmitter valve filaments during stand-by periods to save unnecessary drain on the battery of the AC power supply.

MOBILE SUPPLY

The mobile power supply uses a double vibrator system with two separate supplies feeding through a common filter. One of these is well shielded and filtered to remove vibrator hash and operates the receiver. When transmitting, this supply is switched across to the transmitter and picks up the second supply of the same rating to accommodate the higher current drain. The second supply does not require the same degree of shielding as the first.



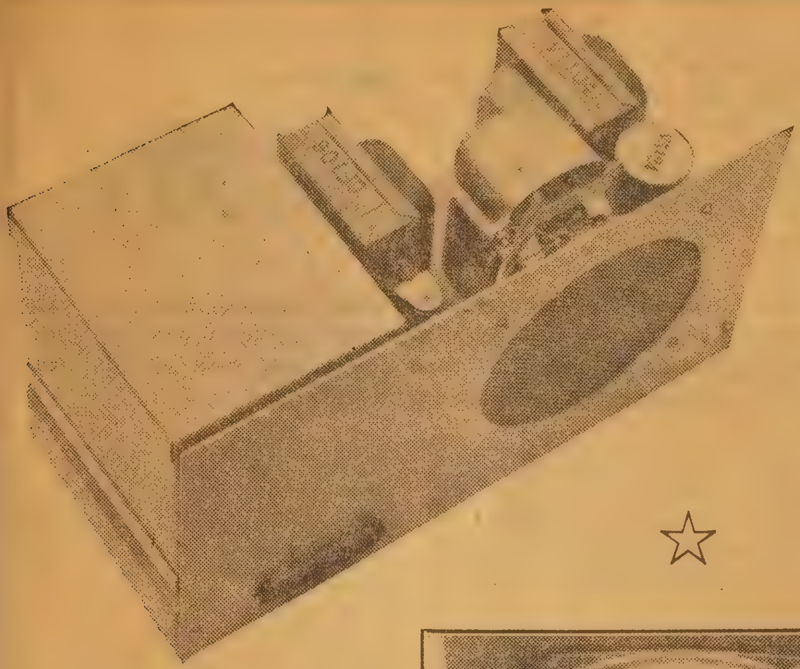
The shielded vibrator with cover removed. Note insulated plate on which the components are mounted. The box is 3 7/8" x 4 7/8" by 4½" high.

This process is handled by a relay in the supply operated from the battery through the transmit-receive switch. This switch also operates the aerial change-over relay, which also completes the power supply connections.

The shielded supply is mounted on a plate within a shield box and insulated from it. All earth points in this supply are grounded to the same point on the plate, which is itself earthed to the box only at the point where the leads emerge.

Failure to observe this rule, clearly illustrated in the circuit, will allow the whole box to radiate hash and spoil reception.

Special chokes are included in the filament and high tension leads to filter this part of the circuit. Rubber grommets are useful to insulate mounting bolts from the main chassis and either grommets or washers can be used to insulate the plate from the



A front view of the vibrator supply, showing the shield box, second supply and filter supply and filter choke. This speaker had its own transformer. Main battery switch is at bottom left.

box. Details of the chokes are given in the coil table.

The transformers are standard 60 mill types and the vibrators synchronous Oak units, specified because they allow switching of the reed current to control the second power supply for transmission.

AC SUPPLY

The loud speaker should be preferably a modern, high efficiency 5-inch unit, not only to ensure it will fit the chassis, but to give best performance. However, we laid out the chassis of both supplies to accommodate the bulkiest 5-inch job we had in the lab, to be on the safe side.

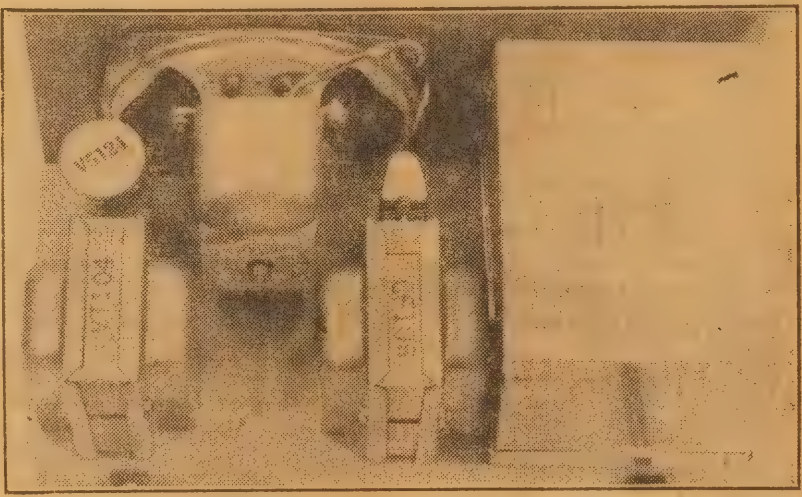
The AC power supply is a simpler job to make and uses a 150 mill power transformer at 285 volts. The transmitter will probably use more current than this, but the transformer will easily handle it for short bursts, and a bigger unit is both bulky and costly. We used one of the biggest we could find, again to make sure of space. The choke is a low resistance, 150 mill type to 12 henries.

Because the relays require DC to operate, we have included a small, telephone type metal rectifier, readily available through disposals for a few shillings, operated from the two 6.3 volt filament windings wired in series. Our transformer had filament windings rated at 4 amps, which again is enough to handle the somewhat higher filament drain for short periods on transmission.

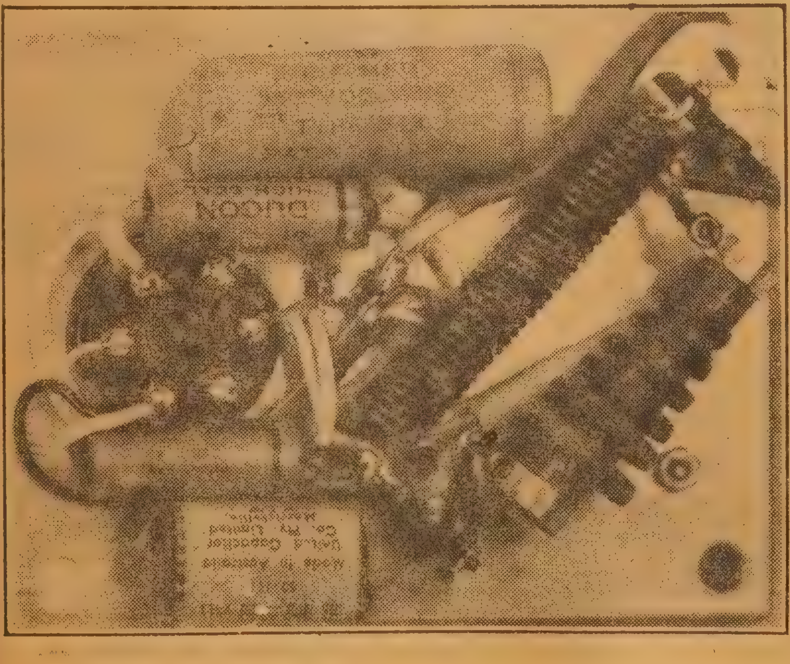
The use of this rectifier allows the same relay connections to be preserved for both AC and battery operation. The relays, incidentally, were again ex-disposals types, readily available from advertisers, having coils of 150 ohms resistance and switching two circuits into two positions. With at least 6 volts available you will find quite a number of different bobbin resistances of a few hundred ohms will work quite well.

Building the equipment poses no special problems as there are no critical adjustments or parts. The main requirement is a little patience and care in handling the miniature components required to make the receiver, but this is an art which is undoubtedly with us to stay with the modern trend to reduce size where possible. You should wire the filaments and various bypasses first of all, as other wires may pass over them. Then would come the IF connections, by which time the groundwork will be laid. Leave the larger

(Continued on Page 109)



A rear view of the vibrator supply. The relay is seen immediately behind the filter choke.



Under the chassis of the insulated plate of the receiver supply. The common earth point is located in the centre of the plate.

Here's your answer, Tom!

It's impossible, Tom, to understand valves without understanding what they are used for. This month, as well as talk about the special valves used in superheterodyne receivers, we will have something to say about superhets in general, pointing out their advantages over straight receivers. We are really getting on to some advanced stuff now!

SO far, we have talked about receivers which use a tuned radio frequency amplifier, a detector and an audio frequency amplifier. The latter may consist of one or two stages, depending on the amount of gain required. The strength of your pocketbook may have something to do with it, too!

Similarly, the radio frequency amplifier may have one or more stages. Tuned transformers are used to couple the aerial to the first amplifier valve and the amplifier valve to a subsequent amplifier or the detector, as the case may be.

Not only do the tuned circuits improve the gain, but they select signals at one particular frequency in preference to all others.

CIRCUITS AND SELECTIVITY

The greater the number of tuned circuits through which the signals have to pass, the better is the receiver able to select the required frequency and reject unwanted signals adjacent to it.

Some 20 years ago, when there were not so many radio stations in operation, a receiver with two RF stages and a total of three tuned circuits would do an excellent job of separating adjacent stations.

As extra stations came into operation, however, it became apparent that receiver selectivity would have to be improved if listeners were not to have their reception of their favorite station interfered with by a newcomer operating on a frequency close by.

The obvious solution was to add more tuned circuits before the detector stage. Sometimes these were accompanied by additional RF amplifier stages and the tuned circuits used as coupling devices, so that extra gain was realised as well.

We can remember some of the receivers using a total of four tuned circuits and three RF amplifier stages. Massive affairs they were, with cast chassis and tuning condensers that would not look out of place on a battleship. You see, Tom, the difficulty was that for each tuned circuit an extra tuning condenser had to be provided.

TUNING SKILL

If each condenser was brought out to a separate knob, it became necessary to develop a high degree of skill to tune in a station, because at least five knobs had to be adjusted. The condensers could be ganged together and operated from a single control shaft to make things easier, but even this was not completely satisfactory, because of the mounting cost and complexity.

This could have been forgiven if the performance of the resulting receiver had been fully satisfactory, but it turned out that the selectivity was still hardly adequate and the sets used to squeal and whistle at the slightest provocation. If radio was to advance, a new method had to be found.

This new method turned out to be the superhet receiver which, with relatively few circuits, was capable of giving the required selectivity.

In the case of the superhet, the incoming signal is changed in frequency by a converter valve, which passes it on to an amplifier operating at a lower frequency than the signal. At the lower frequency the required gain and selectivity can be had in a fewer number of stages.

Furthermore, the amplifier need not have variable tuning, which greatly simplifies the mechanical problems.

The degree of selectivity which can be achieved in a given number of stages depends on the frequency chosen. If it is as low as 50 Kc, say, "razor-sharp" selectivity can be achieved with even one stage. However, there are other disadvantages in using a very low frequency and in practice it has been found that a frequency of about 455 Kc is about optimum.

There is usually a one or two-stage amplifier at 455 Kc, which is followed by a detector and audio amplifier. Except for the fact that the 455 Kc amplifier is permanently tuned to the one frequency, it is the same as the radio frequency amplifier in an ordinary tuned radio frequency receiver. Similarly, the detector and the audio amplifier are essentially the same.

VARIOUS ARRANGEMENTS

However, before the benefits of the 455 Kc amplifier can be realised a converter stage must be used to change the incoming signal to the lower frequency. You can see tha it would be no use at all having a 455 Kc stage, giving improved gain and selectivity, if these benefits cannot be applied to the signal.

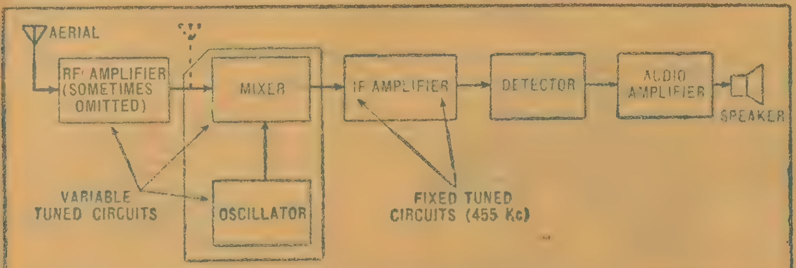
There are a number of physical arrangements of valves and coils, &c which will convert the incoming signal to 455 Kc, or the intermediate frequency as it is called, and we wil have more to say about these in a moment. They all work by virtue of the heterodyne principle.

The signal you wish to receive may be at 900 Kc and, to obtain a signal at 455 Kc, it is necessary to mix the incoming signal with a signal differing in frequency by the intermediate frequency. This could, of course, be 445 Kc or 1355 Kc. There are usually advantages in choosing the higher of the two possible frequencies.

We won't spend too much time explaining why the mixing of two signals differing in frequency by 455 Kc produces 455 Kc in the output of the converter circuit. There is an equivalent in ordinary sound to the electrical phenomenon which may help to fix the idea in your mind.

THREE FROM TWO!

If you press a note somewhere on the piano keyboard you will hear the tone as usual. Then try another note close by. But if, instead of pressing them separately you press them both together, you can, by listening carefully, hear three separate notes. Two will be the notes you have already heard but, in addition, there will be a much lower note. In fact, it may be so low that it just sounds like a variation in the intensity of the other notes



This block diagram shows how a superheterodyne is made up of co-ordinated units.

Try it with various notes on different parts of the piano.

If we decide to make a superhet receiver with a 455 Kc IF amplifier to receive a signal at 900 Kc it will be necessary to include an oscillator operating at 1355 Kc. The signal from the aerial and the signal from the oscillator are mixed together so that the heterodyne or beat signal is generated and then passed on to the 455 Kc tuned amplifier.

It isn't hard to see, Tom, that if the signal generated by the local oscillator is varied in frequency while the IF remains fixed, the frequency to which the receiver as a whole is tuned will be varied. For example, if the local oscillator is tuned to 1455 Kc an incoming signal at 1000 Kc will be required to beat with the local oscillator to produce 455 Kc.

With a little thought you will see that an incoming signal at 1910 Kc will also pass through the IF channel. To prevent this a tuned circuit which accepts the 1000 Kc signal but rejects the 1910 Kc signal is placed ahead of the mixer stage. At these frequencies it isn't hard to design an efficient circuit to do the job.

PERCENTAGE DIFFERENCE

The difficulties arise when the desired signal is at a high frequency. The higher the frequency the smaller the percentage difference between the desired signal and the "image" and the greater the difficulty in designing a tuned circuit to choose between them.

The solution is sometimes to use more than one tuned circuit although, at very high frequencies, it is desirable to use a higher IF so that the signal and images are separated by a greater amount.

Our main concern this month, Tom, is to say something about the valves used to mix the incoming signal and the local oscillator output.

About the simplest way of mixing two radio frequency signals is to apply them simultaneously to the grid of a radio frequency amplifier stage. Best mixing is obtained if the standing bias on the grid of the stage is made higher than normal so that the valve is operating on a curved portion of its characteristic.

In practice, a circuit tuned to the frequency of the incoming signal and coupled either to the aerial or the preceding RF amplifier is connected to the grid of the mixer stage. As the signal received by the aerial is likely to be very weak every effort is made to transfer it to the grid of the mixer without loss.

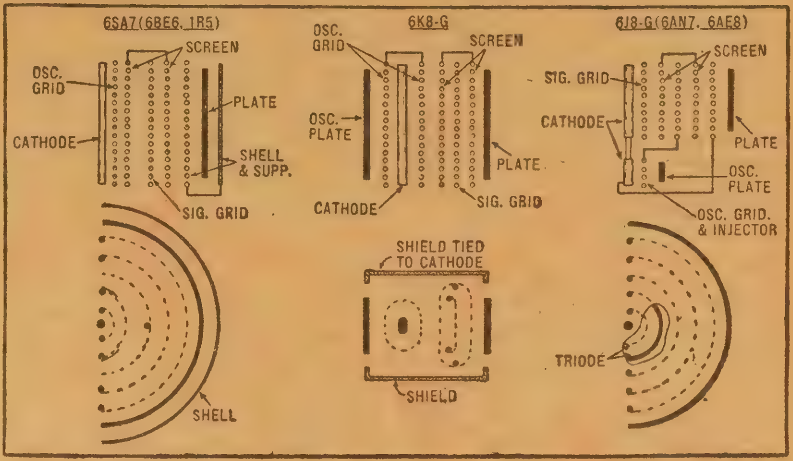
STRONG OSCILLATOR

The signal from the local oscillator, on the other hand, is comparatively strong. It can successfully be coupled into the mixer grid by a simple condenser.

Although this arrangement can be made to work well, it has a number of disadvantages which have caused it to be superseded by others.

When tuning over a wide range of frequencies it is very difficult to keep the output of the local oscillator constant. In most receivers, the output of the oscillator varies over a wide range as the receiver is tuned from one end of the band to the other. With the grid injected mixer, this results in a similar variation in gain.

Another disadvantage is that the tuning of the circuit in the grid of the mixer has an effect on the tuning of the oscillator which is often very much of an embarrassment. Also, if the receiver has no RF stage some of the signal from the oscillator is radiated by the aerial. This may cause whistles in nearby receivers.



Showing the electrode construction of various converter valves.

The disadvantages of this system are often not so apparent in the case of receivers operating at high frequencies and tuning over a relatively narrow band of frequencies. Some of the other mixing systems do not perform particularly well at

(Continued on Page 97)

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Let's Buy An Argument

The brief and rather exploratory screed which I wrote last month on the subject of reactivating dry batteries has evoked an immediate interest. Most gratifying of all was receipt of a letter from one of the local battery manufactures, setting out their ideas on the subject.

HITHERTO, battery manufacturers in general have not had much to say on the subject. Their reticence is perhaps understandable.

If they'd claimed that reactivation was a bad proposition, they would obviously have been accused of self-interest.

If, on the other hand, they'd said it was a good thing, they would have incurred by implication a responsibility to establish recommended procedures and new figures for "reactivated life".

In saying nothing, they've had to grin and bear a variety of misinformed statements — many of them technically unsound.

PURELY OBJECTIVE

I had no desire to add further to the confusion, hence my attempt to make an objective assessment of the pros and cons. Apparently, it was pretty close to the mark.

To be sure, one reader whom I've quoted assumes that I have no faith in battery reactivators. That is hardly what I said.

The whole inference of the article was that reactivation was an entirely feasible scheme, but open to serious abuse. On the one hand, overcharging could ruin batteries and ruin valves. On the other, inadequate design could either give no benefit at all or lead to an actual discharge while the batteries were supposed to be reactivating.

by W. N. Williams

I suggested further that the most optimistic reports, based on carefully timed or automatic load cycles, were not typical of conditions under actual service. The problem was to evolve reactivators that the general public could use and understand—and still get some benefit from.

You remember that I tipped John Citizen to get double life from his batteries or a little more, under average conditions.

Of course, the seemingly obviou answer was to get some batteries an try it in practice. Why beat abou the bush?

It looks a fine scheme until yo work out what it involves.

Simultaneous tests would have t be run on batteries used normall and with reactivation, preferably a high, medium and low "charging currents. Each test would have t be run in duplicate to minimise ris of striking a specially good or specially bad unit.

You would logically have to chec both A and B batteries and, preferably, large and small types. Tha adds up to a lot of batteries and lot of individual readings.

A LONG TIME

Further to complicate matters, th service life of a battery might b say, 250-300 hours, on the basis o average daily use and drain. If yo reckon on three hours a day for working week (we also mow lawns &c., at the weekend) it adds up t a three-month job before the non-reactivated battery reaches the end-of-life point.

But the others should still be goin merrily on their way, leaving you further three to six months of takin and plotting readings.

The natural urge is to leave tha kind of thing to people who are pai to do it.

In the meantime, I've had a reactivation circuit running for a fe weeks on what I hope is a down-to earth basis.

At this early stage, the curve of th battery terminal voltage is headin nicely out into the 80-90 volt regio with no suggestion of trouble. I looks to be working fine, but that' as much as one can say at thi moment.

I've also succeeded in getting quit a few hours' playing from anothe near-discarded battery that had bee left lying around the place. Mayb you can't properly reactivate worn out batteries, but it certainly help to get a little bit extra for nothing— if you don't count the few watts loa on the power circuit.

SIMPLE DEDUCTION

In fact, it looks very much a though the average user can benefi by reactivation, provided he can b trusted to make a simple deductio and note for how long the batterie are used each day, then reactivat for so many times that period.

I doubt if there's much future i our correspondent's idea of meters automatic cut-outs and such like

(Continued on Page 73)

REACTIVATION—WHAT A BATTERY MAKER THINKS

Dear Mr. Williams:

In view of the fact that you have made some comment on reactivating dry batteries in the October, 1953 issue of your publication, we thought the following additional comment may be of some interest to you.

The Research Laboratories of our Associates, the National Carbon Company in the USA, have been experimenting with various recharging procedures and circuits over the past 20 years.

In Australia, we have carried out tests over the past four or five years and, in general, we concur with the overall statement that dry batteries can be recharged subject to the following limitations:—

1. *Batteries should be reactivated by passing a reverse current through them after each period of discharge.*
2. *The amount of charge in ampere-hours should be 120 pc to 180 pc of the amount of discharge during the last preceding period of use.*
3. *To avoid damage, the charging rate should be maintained low enough to extend the required charge over a period of not less than 12 hours.*
4. *Batteries which have been reactivated, subsequently have a short shelf life.*
5. *Reactivation is more effective with recently manufactured batteries than with those near the end of their shelf life.*
6. *If the conditions under which reactivation is carried out are incorrect, it is possible for the battery to be damaged, resulting in less rather than more service.*

In the book "Primary Batteries" by G. W. Vinal, Chief of the Division of Electro-chemistry of the US National Bureau of Standards, reference is made to the fact that while a dry-cell is ordinarily considered a primary battery, it can be "recharged" for a limited number of cycles under specific conditions, as above.

EARLY RESEARCH

There have been several papers published on the subject and one we would refer you to for further information is entitled "The Effect of Applying a Counter E.M.F. to a Le Clanche Cell" by K. A. Kobe, Assistant Professor of Chemical Engineering at the University of Washington, and R. P. Graham, published in Transactions of the Electrochemical Society 73:587-603 (1938).

There was considerable discussion on this paper when it was presented and from this it is quite evident that the chemical reactions that go on during reactivation are not fully understood and, furthermore, the extent to which the reactions associated with discharge are reversed, depends upon the conditions under which the reactivation is applied.

In some experiments there has been evidence that a small amount of zinc may be plated back on to the can, and there has been some conversion back to manganese dioxide. Others have found that the zinc appears, under some conditions, as thin needles which internally short circuit the cell and the net result is, of course, less rather than more service.

It would appear that one of the more important effects is the production of chlorine, which would account for the high voltage of cells that have recently been reactivated.

Our own experiments, using a commercial portable receiver incorporating reactivation, have shown that it is possible to obtain a closed circuit voltage as high as 1.96v per cell from a battery that has been reactivated, and this high voltage could be explained by the production of chlorine.

If this is so, it would appear that a new reversible reaction involving free chlorine is taking place during the charge and subsequent discharge periods.

A point brought out in the discussion on this paper was that, if the reverse current is too high, or if the reactivation is carried on for too long, the electrolyte will be carried out of the paste lining, resulting in a dry lining, which has a destructive effect on the cell. It is significant that, in batteries which have been returned to us with the claim of short service life, it has been found that the paste was very dry and this, no doubt, could be accounted for by excessive reactivation.

NOT DEFECTIVE

There is no doubt that reactivation correctly applied gives an increase in service life in the majority of cases, but it cannot be assumed that a battery is in any way defective simply because it does not yield any extra life when reactivated.

It will be suggested, of course, that battery manufacturers should develop special types of dry cells that are particularly suited to the application of reactivation, and the obvious answer to this is that such a battery has been produced in the form of the jelly-acid accumulator, which is a true secondary cell.

Unfortunately, the properties of a Le Clanche dry cell that would make it particularly suitable for repeated recharging, would not be those which would result in the greatest service capacity when discharged normally.

It has been found that cells using the most efficient depolarisers, incorporating special materials, which result in considerable increases in service capacity under heavy service conditions, yield much smaller increases in service life when reactivation is applied than do flashlight cells of the same size designed for light intermittent operation. It will thus be seen that the more efficient a dry cell is, the less effective reactivation becomes.

It would be possible, of course, to increase greatly the zinc thickness to avoid the possibility of perforation in the case of round cells, but this would be no advantage if the cells should then fail because of some other cause, such as the drying out of the electrolyte paste, or an internal short circuit brought about by the application of reactivation.

"EVEREADY" batteries are designed to give the longest service when discharged normally in the usual application for each particular type. Consequently, if the service life obtained from a battery, to which reactivation is applied, is at least equal to that which it would give when discharged normally, without reactivation, it is our view that it has done all it was designed to do.

SPECIAL CIRCUMSTANCES

Of course, if additional service is obtained as the result of reactivation, that is a matter for general satisfaction but, due to the complexity of the chemical reactions that can occur during the process, it cannot be assumed that all batteries will behave in the same way under these unusual conditions. Already cases have come to our notice where no additional service life was obtained.

As the zinc, which is consumed during discharge, is not plated back on to the surface of the zinc can to any great extent during reactivation, perforation and subsequent electrolyte leakage is likely to occur in round-cell batteries whose service life has been increased appreciably by reactivation. This effect is likely to be accelerated where the batteries are used in sub-tropical areas.

Another factor, which does not directly concern us as dry battery manufacturers, is the increase in "A" battery voltage that is brought about by dry battery reactivation.

After reactivation, we have found that the closed circuit voltage of the cells in, for example, an "EVEREADY" No. 719 battery, can be as high as 1.96v and it sometimes takes more than two hours discharge in a 50mA valve filament circuit before the voltage falls to the nominal value. This, we believe, would have an adverse effect on valve life.

The greatest increase in service life, due to reactivation, is obtained when batteries are regularly subjected to heavy discharge and reactivation is applied immediately after use. Substantial increases can be obtained when the discharge-reactivate cycle is repeated continuously, but of course these conditions do not usually occur in practical applications.

Where discharge is intermittent with long rest periods in between, there is little, if any, benefit to be obtained from reactivation, since shelf deterioration is accelerated.

Yours faithfully,
Everready (Aust.) Pty. Ltd.
Peter Adams,
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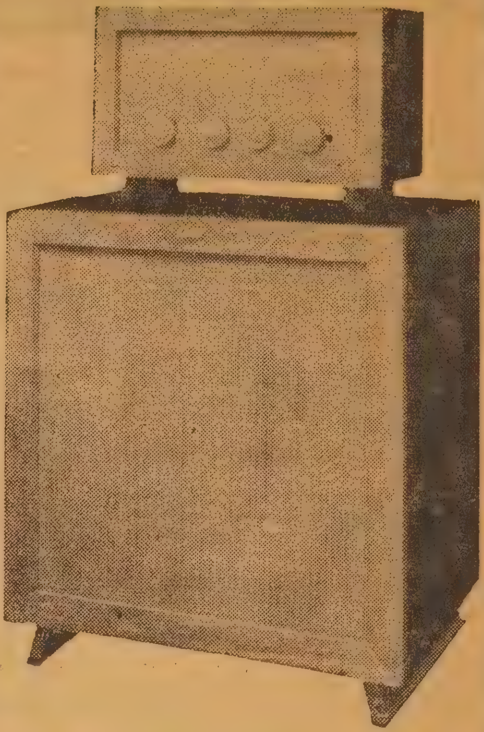

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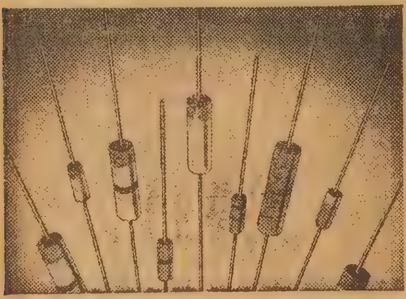

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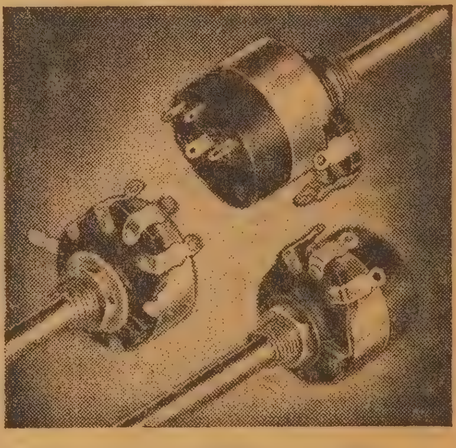
These moderately priced Resistors combine high performance with unusually small size. They are made accurately to their stated resistance values and are consistently stable.

The simple construction of Morganite Resistors provides small, robust, lightweight components of high power dissipation and low operating temperatures, and are colour coded to RMA standard.

MORGANITE POTENTIOMETERS

New in design, robust and reliable. Available non-switch and with S.P.S.T. and D.P.S.T. switches, rated and approved to 2 amps.

Overall diameter 1⅛in. Double-clench terminals eliminate noisy joints. Double-prong spring contacts in special non-tarnishing metal for resistor sweep, maintain correct pressure for minimum noise without wear. They withstand the most rigorous operating conditions.



THE MORGAN CRUCIBLE CO. (Australia) PTY. LTD.

Head Office: 65-67 Bourke Rd., Alexandria, N.S.W. Phone: MU1371. Telegrams: "Morganite" Sydney.
272 City Rd., Sth. Melbourne, S.C.5, Vic. Phones: MX6106-7. Telegrams: "Crucible" Melbourne.

Let's Buy An Argument

(Continued from Page 70)

Quite apart from the cost of such items, I think you'd find that the average user would be scared off by devices and procedures that looked too technical.

"All right for those wot dabble in such things, &c."

For the rest, I'll leave you to study the letter by our good friend, Peter Adams, of the Eveready Company.

Meanwhile, to change the subject rather abruptly. I have suddenly found myself answerable, in an argumentative way, for an article in the last issue on tape deck design. It was submitted, you may remember, by an outside contributor, Mr. P. D. Thomas.

ARGUMENT EXPERTS!

As I remarked on a previous occasion, when it comes to "buying an argument", I'm a mere novice compared with the gentleman in question. He seems to have a real flair for picking fights.

Soon after the issue appeared, I answered the phone to hear someone ask me very forcibly whether I had built a tape deck to the design suggested by Mr. Thomas. If I had, did it duplicate the results apparently given by the original?

The answer was obvious enough —I hadn't built it. The article was purely a contributed effort, accepted, paid for and published in good faith

If I, or any other member of the staff had built such a deck, we'd have written the article ourselves, in line with our usual practice with receivers and amplifiers. "However," I explained, "there was a practical limit to the amount of work one could do and we had no reason to doubt Mr. Thomas' bona fides . . .&c."

It seemed that this reader took exception to Mr. Thomas' approach on several counts, based on his own experience with similar decks.

For example, he strongly condemned the use of ball races on the score that they gave frequent trouble with rumble, which even appeared ultimately as a modulation component on the tape. He didn't think they were anything like as good a proposition as plain self-oiling bushes. The ideas weren't new to me.

MANY CRITICISMS

I've heard ball races criticised before, as applied to tape recorders. Those who don't like them make the following points:

(1) They produce rumble, as already mentioned.

(2) A bad bump will impress a pattern of the balls into the race or vice-versa, making it thereafter completely hopeless.

(3) They need regular oiling and, in practice, the surplus oil inevitably finds its way onto rubber belts and tyres inside the recorder.

(4) Conventional oil-impregnated bearings are cheaper, more easily fitted and aligned, need no subsequent lubrication, are smooth-running and do not introduce excessive friction.

Faced up with these ideas the supporters of the ball races answer them in the appropriate order.

(1) Phooey!
(2) Phooey!
(3) Phooey!
(4) Phooey!

(Continued on Page 111)

VARIETY OF SUBJECT MATTER

TAPE DECK

I have made a point up until now of keeping away from controversy regarding tape decks. However, I must take exception to Mr. Thomas' choice of flywheel.

I have found from experience that, to successfully drive a capstan from a BSR FP10 motor, a flywheel of at least 4in diameter, running to at least 600 rpm, is necessary to avoid severe wow. Mr. Thomas' 3½in diameter flywheel, running at around 200 rpm, would, except in most unusual circumstances, give intolerable results. Another inch in diameter would cost only a few shillings more for casting, while a higher speed costs no more.

This brings us to the point of why the very large capstan? It is probably the largest I have seen in any design, certainly larger than commercial recorders of even low quality. Most recorders use capstans in the range 3-16in to ¼in. (R.T., Arncliffe.)

OVERSEAS DESIGN

I read with interest your article in Radio and Hobbies' September issue. Insofar as the respective merits of British and Australian designs are concerned, I can't myself see that there is much to choose between them. Standard radio circuits do not differ greatly in any country for, after all, there is a practical limit to what can be done with a small number of valves.

I have only resided in Australia for some 16 months and, while I have not had the opportunity yet to start any home construction, I did while at home in England make a practice of building my own receivers. There is only one difference in the two locations, namely, radio parts are cheaper and easier to obtain back home and one has a much wider choice.

Regarding your remarks on AC/DC circuits, I have built several receivers of this type, nevertheless I agree that they are unsafe in unskilled hands. The chief reason why AC/DC circuits still appear in British magazines is simply that they are necessary, as there is still a good deal of DC main in Britain. In London itself there are districts still on DC, even with AC type mains.

The voltage on AC is not standard and a transformer primary must be tapped to operate from 210 to 250 volts. This means at least five taps, which no doubt adds to the expense and is one reason why small sets such as you comment on only use a filament transformer, which is usually purchased to suit the local voltage. In passing I might mention that 50 cycles is the normal frequency, but there is at least one district in London where it is 60 cycles.

In the television field most of the lower-priced models make use of the AC/DC circuit and provide EHT by line flyback or RF circuits.

Prior to this people on DC mains either did not buy a TV, or had to use a rotary converter to provide the AC. From this you will see that in respect to power supplies from the mains the Australian manufacturer is more fortunate in having a standard voltage to work from. (J. D. R. Mosman, NSW.)

REACTIVATING BATTERIES

I have always read "Let's Buy an Argument" with great interest. I am always amazed by the great mass of information you have at your disposal. The kind of stuff you don't find in textbooks.

It appears that you have no faith in battery reactivators. It is possible that the subject has not been fully exhausted. I believe that the difficulties you foresee may quickly be overcome.

For instance, about a year ago I read a par in a Braille magazine. It seems that the device you described is to be manufactured in Britain to recharge batteries used in deaf aids. What you did not mention, but this journal stated, was, that for every period of time the batteries are used they should be charged for an equivalent period of time. Surely this procedure may easily be followed by the average user. It would seem that the complications you speak of hardly exist.

As a precaution against overcharging, surely the activator would be fitted with a meter or meters showing both LT and HT voltage readings. The user could be instructed about the Danger Line for both readings.

For little extra cost, timing switches could be fitted to cut the power at a set time. To carry it farther, a series of trip switches could be made to function when the voltage had reached the Danger Line.

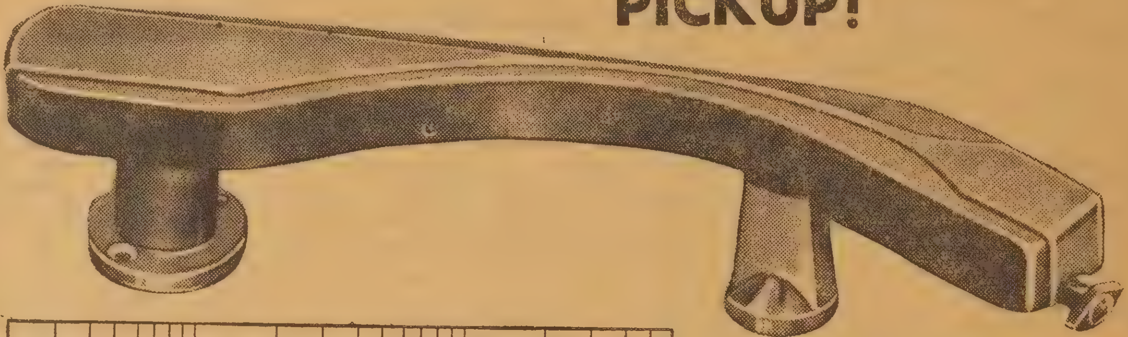
I think it is important to perfect some kind of primary cell RF activator, as it would save the country a great deal of expense in the manufacture of these dry batteries. I believe the difficulties you mention could all be overcome.

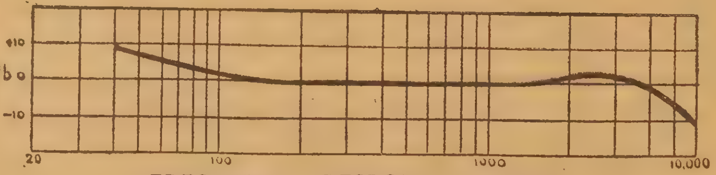
However most of what I have learned about it, has been from your informative article. (G.N.W., South Yarra, Vic).

THAT METER SCALE

"Let's Buy an Argument" for August shows a meter scale. The "cause of much contention" is the db. scale, but what puzzles me is the ohms scale! It reads 11.1 omhs in the centre. I could understand it reading 15 or 16.6 ohms. Sometimes the scale is reversed, 0 ohms being on the left, i.e., at 0 mA and centre scale is 9.8 ohms. Please, would you explain? (R.G., Wonthaggi, Vic.)

ANNOUNCING A NEW "Turnover" Magnetic PICKUP!





FREQUENCY RESPONSE CURVE

Featuring the "Goldring" MAGNA CARTRIDGE No. 200

SPECIFICATION

Output Voltage: 500mV at 3.16 cm/sec RMS.
DC Resistance: 7000.
Stylus Pressure: 14 grs. Std. & LP.
Stylus Dimensions: Standard 0.00275 inches Rad. Sapphire LP. 0.001 inches Rad. Sapphire.
Impedance: 40,000 at 1000 cycles.
Optimum Load: 100,000.

The Magna Cartridge No. 200 has been specially designed for use under tropical conditions of heat and humidity, and can be most highly recommended for all territories where experience has shown crystal cartridges to be unsuitable.

An entirely new principle in design makes possible an output comparable with an equivalent crystal cartridge. The same output for both Standard and LP records.

It is the first magnetic cartridge using cantilever styli replaceable by the user, perfect tracking of both types of records with 14 gms. Interchangeable with other cartridges in almost all types of 3-speed record changers.

OF GREAT INTEREST TO ALL USERS OF

BRITISH BSR THROUGHOUT

GU-4 UNITS

The B.S.R. Unit GU-4 which enjoys unparalleled popularity, not only in Australia but all over the world, has in the past been fitted with a variety of pickups which were, at various times, the best obtainable for use with such a quality motor unit. However, progress has made some of the types used obsolete and we feel sure that many thousands of satisfied owners of the GU-4 unit will be pleased to learn that they can now bring their unit up to date by acquiring the Magna Cartridge. These cartridges will be supplied complete with the new pickup arm No. 200 and can be fixed to the GU-4 unit without technical skill.

When Ordering Use Correct Description:
MAGNETIC TURNOVER PICKUP No. 200 — Complete Pickup. Price, £5/5/-.
PICKUP ARM & CARTRIDGE No. 200 — For use with GU-4. Price, £4/15/-.
MAGNA CARTRIDGE No. 200 — Cartridge, with Bracket for use with 3-speed Changers. £3/2/-.
REPLACEMENT NEEDLE STYLI S/10—(Standard: Green; LP: Red). Price, 14/6.

GOLDRING ENGINEERING (AUSTRALASIA) PTY. LTD.

57 H.E. AREA, ST. MARY'S, N.S.W.

Goldring

PREVENT RECORD WEAR . . .

Enjoy Better Reproduction and less Surface Noise

Change NEEDLE STYLI REGULARLY!

A good quality **sapphire** needle stylus, as incorporated in the equipment of reputable manufacturers, should survive many hundreds of playings for standard records, and at least one hundred playings for LP records before wear causes damage to records and inferior reproduction.

But such life expectancy can be substantially reduced. Faulty, chipped or dust-laden records can have disastrous results. The weight, damping and tracking of your pickup affect the rate of wear. And, most important, the method of handling (gentle or otherwise) either manually or by the record changer.

Safeguard your valuable records . . . the cost of regular stylus replacement is negligible in comparison.

DANGER SIGNALS

Standard Records. Black dust accumulating on needle point and increased surface noise.

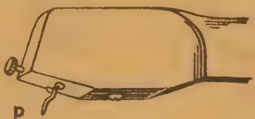
LP Records. Fine thread or fluff at needle point and discolouration of grooves.

You can easily change the needle stylus yourself. Read the identification details and fitting instructions. All leading retailers stock "Goldring" replacement styli.

PICKUP IDENTIFICATION

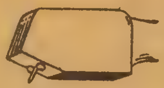
★ For Standard "78" Records only:

Group A:
Magnetic and crystal pickups using needle screws.

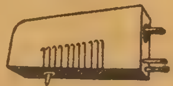


★ For Standard "78" and L.P. Records:

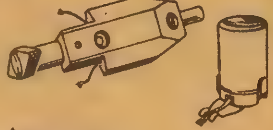
Group B:
Light weight pickups using miniature needles of push-in type.



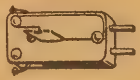
Group C:
High fidelity pickups with styli as integral part of their construction.



Group D:
Crystal and magnetic cartridges using push-in cantilever styli.



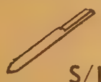
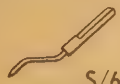
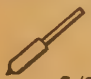
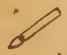
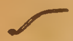
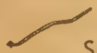
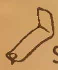
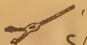
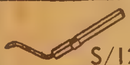
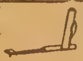
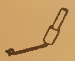
Group E:
Crystal cartridges with screw-in cantilever styli.



● *All styli are available* for standard marked *Green*, for L.P. (Microgroove) marked *Red*. *The only exception is the No. 150 stylus,* where standard is marked *Blue*.

NEEDLE STYLUS REFERENCE CHART

Check for detail only . . . needles are NOT shown in actual size.

GROUP			
A	 S/1	 S/6	S/1 is recommended for light crystal pickups. S/6 for record changers and both crystal and magnetic pickups, minimising record wear.
B	 S/3	 150	S/3 for Connoisseur, Goldring 121, 122, H.M.V. and other light weight pickups. 150 for Goldring 3-way pickup. *Blue* stylus for Standard. *Red* for L.P.
C	★ Styli, being an integral part of pickups in this group, cannot be supplied. New styli will be fitted at moderate cost by Goldring Service Department, 57 H.E. Area, *ST. MARYS, N.S.W.* Please take cartridge to your retailer, who will make necessary arrangements. The best known pickups in this group are the *Goldring Headmaster* and the *Decca magnetic* pickup. In the case of the latter it will be sufficient for armature to be sent in to effect styli replacement.		
D	 S/8	 S/9	S/8 for BSR. record changer. S/9 for various Acos cartridges. The main difference between S/8 and S/9 is length and angle. As the angle cannot be re-set watch this point carefully. S/9 used by Collaro, Garrard, Acos and others. S/10 for Goldring Magna cartridge No. 200. S/11 for Plessey Changer. S/12 Garrard "Astatic" U.K. S/13 Garrard "Astatic" U.S.
	 S/10	 S/11	
	 S/12	 S/13	
E		S/7	S/7 used in *Goldring turnover* pickup, *BSR. unit* GU-4, *Stromberg-Carlson* changer, *Garrard* changer, *Acos* pickup, etc.

● The above styli cover almost 100% of equipment sold in Australia. Regarding new and off-standard types refer to Goldring Service Department for information and help.
All Goldring needle styli are of finest quality and produced to most exacting standards, backed by long experience. Prices kept at lowest economical level. Do not confuse with *cheap* needles on the market. *Insist on genuine Goldring replacement styli.*

You can easily change styli yourself. A small screwdriver and a small pair of flat pliers are the only tools required.
First identify the PICK-UP GROUP from chart above;
Then further check against the STYLUS REFERENCE CHART at left.

FITTING INSTRUCTIONS

GROUP A: No tools required.
GROUP B: Styli to be inserted without side pull or bending. It is important for needle point to be perfectly straight over record.
GROUP C: Styli replacement by Goldring Service Dept.
GROUP D: Withdraw old needle styli by gentle but straight pull and insert new styli without using force in the same manner. Using force would damage pickup mechanism as well as possibly snap off cantilever of stylus. If cartridge is inaccessible for effecting styli change while cartridge is in position, it can easily be removed in all cases by unscrewing cartridge from pickup arm.
GROUP E: Turn cartridge until styli holding screw in centre of cartridge shows. By unscrewing it, both styli can be withdrawn simultaneously and new styli inserted, making sure the flats of these go inside.

GOLDRING ENGINEERING (AUSTRALASIA) PTY. LTD.

57 H.E. AREA, ST. MARY'S, N.S.W.

WILLIAM WILLIS & CO. PTY. LTD.

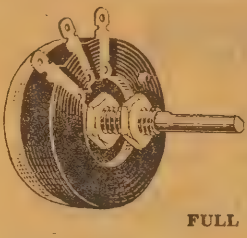
428 Bourke Street, Melbourne, C1.
Phone MU2426

TELCON VALVE SOCKETS

ST27-G Miniature 7-pin black Phenolic .. 1/3 ea.
ST27-L Low loss mica filled .. .. 1/9 ea.
ST19-G Noval 9-pin (black) 1/3
ST19-L Noval 9-pin (low-loss) 1/9
ST28-G Octal 1 5-16in mtg. centres .. .. 1/- ea.
ST38-G Octal 1½in mtg. centres .. .. 1/- ea.
ST28-L Octal mica filled 1 5-16in mtg. centres, ... 1/3 ea.
ST38-L Octal mica filled 1½in mtg. centres, 1/3 ea.
ST57-G 7-pin Miniature W/shield black moulded .. .. 4/6 ea.
ST57-L 7-pin Miniature W/shield, mica filled .. .. 5/6 ea.

3 Watt WW Potentiometers

Bulgin
IVC Series

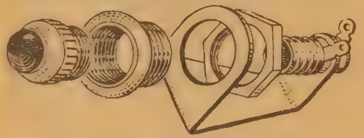


IVC 5	47	ohms
IVC 7	100	"
IVC 8	150	"
IVC 12	680	"
IVC 14	1500	"
IVC 15	2200	"
IVC 16	3300	"
IVC 18	6800	"
IVC 19	10,000	"
IVC 20	15,000	"
IVC 23	47,000	"
IVC 24	68,000	"

7/9 EACH

FULL RANGE IRC POTENTIOMETERS CARRIED IN STOCK

INDICATOR BEZELS



BULGIN

D370 SERIES (as illustrated) M.E.S. fitting, front loading. Available Red, Green, Blue, Amber, White. Ea. **6/-**

D170 SERIES (Lamp mtg. in vertical plane.) M.E.S. Fitting. Back loading. Available Green, Red, Blue, Amber. Ea. **4/6**

D7 SERIES Hexagonal Lenz Plate, vertical lamp mtg. M.E.S. Fitting. Available Red, Green, Blue, Amber. Ea. **4/2**

D600 1½in diam. Bezel only, less lampholder. Suitable for mtg. in front of std. 15-watt lamp or radio panel lamp. Each **3/7**

D50 SERIES metal body "wide-vision" Lenz, black moulded bezel holder. M.E.S. lamp fitting. Both contacts insulated off frame. Lamp totally enclosed in horizontal plane. Translucent Lenz. Available Red, Green, Blue. Each **7/9**

FLASHERS !

British C. & R. Type B. 200-250 volt flasher units. Ideal for Christmas tree and window display lighting effects. Will handle up to 100 watts. Ea. **28/10**

SPECIAL !

Small Disposals Stock, 955 & 954 Acorn Tubes .. .. 10/- ea.
866 Valves .. .. 25/- ea.
8-Position British Press-Button Units — Silver Plated Contacts .. .. 14/- ea.

SCOPE ELECTROPLATING SET

STANDARD SET IN SOLID WOODEN CASE. (Nickel, Copper, Tin, Zinc). **48/6** (Batteries Extra 2/- per set.)

Jeweller's Set. (Nickel, Copper, Silver, Gold) 66/9.

EXTRA AND SPARES

Gold, 15/9 per jar; Silver, 8/6; All Other Metals, 3/-; Clear Metal Lacquer, 3/-; Electrolytic Cleaners, 3/-.
Postage: W.A. & Q'ld., 5/-; S.A., N.S.W. and Tas., 3/8; Vic., 2/3.

Photo-Flash Capacitors

T.C.C. "HIKONOL" Photo-Flash Capacitors — small quantity available from stock. Capacity 28 MFD: Maximum Flash Voltage 2.5 K.V. DC. Prices and details on application.

NEONS

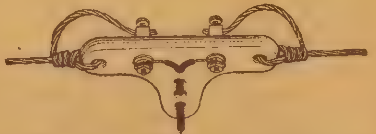
G.E. NE-51 MBC Base, ¼-watt . 2/6 ea.
G.E. NE-2 Pigtail, ¼-watt .. .. 2/6 ea.
MBC Base, suit NE-51 .. .. 1/7 ea.
Panel mtg, MBC holder. Bulgin D621 .. .. 5/1 ea.
Panel mtg "Lumolite" Type PL2, 240v Neon Indicators 18/6 ea.
Panel mtg "Lumolite" Type FP3, 240v flush Neon Indicators, fit normal flush switch plates .. 9/10 ea.

COAXIAL CABLES

AERIAL EQUIPMENT
BELLING & LEE
TRANSMISSION CABLES

Type L688 Semi-air spaced 68-78 ohms .. .. 3/3 yd.
Type L600 Solid Co-axial 60-74 ohms .. .. 2/3 yd.
Type L809 Solid Co-axial 45-55 ohms .. .. 3/10 yd.
Type L1221 Screened Twin Co-axial 60-75 ohms .. .. 2/3 yd.
Type L336 Twin flat line 75-85 ohms .. .. 1/2 yd.

14G. Hard Drawn Copper Aerial Wire. Yard **6d**



L333 "T" CERAMIC CENTRE INSULATOR 7/6 each

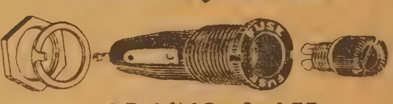
Suit Belling & Lee cables. Types L600, L809, L1221, L336.
Belling and Lee Type L733/P 72 Twin Flat Line 2-Pin Plug 1/6
Belling and Lee Type L733/S 2-Pin Chassis Socket 9d
Belling and Lee Type L677P 300 ohm Twin Line 2-Pin Plug 1/6
Belling and Lee Type L677J 300 ohm Twin-Line 2-Pin Socket 1/6

THE PERFECT CONNECTORS FOR BELLING AND LEE 72 OHM AND 300 OHM TRANSMISSION CABLES

Belling and Lee Type L734/P Nickel Plated Brass Co-Ax Connector Each 2/6
Belling and Lee Type L604S Chassis Mtg. Socket to take L734/P Co. Ax Connector. Each 2/4

IDEAL ALSO AS MICROPHONE AND PICK-UP CONNECTORS

FUSE EQUIPMENT



BELLING & LEE

L356 Panel Mtg. Fuse Holder (as illustrated) 6/8.
L510 Cartridge Fuse Clip, 2/1.
L1055 Fuse Cartridges. 60mA, 100mA, 150mA, 250mA, 500mA, 750mA, 1 amp, 2 amp, 3 amp, 5 amp, 10 amp, 15 amp, 1/- ea.
L575 Miniature Fuse Holder. Panel mtg. Similar to L356, 4/- ea.
L562 Mini-Fuses. 50mA, 100mA, 150mA, 250mA, 1 amp, 7 amp.
50 & 100mA, 3/5 ea. 150 & 250mA, 3/2 ea. 1 to 7 amp, 1/4 ea.

VACUUM THERMAL DELAY SWITCHES

Thermal delay switches of the vacuum variety are recommended for use with mercury vapour rectifiers to provide the necessary delay before anode voltage is applied. The normal average delay time is 60 seconds but variations above and below this period may be effected by adjusting the nominal filament voltage of 4 volts above and below this value.

To overcome the disadvantages of the ordinary bi-metallic strip delay switch, the parts of the thermal delay switch are enclosed in an evacuated glass envelope.

RATINGS: TYPE DLS-10

Filament Volts	4.0 Volts
Filament Current	1.5 Amps (at approx 4 volts)
Delay Time at 4.0 volts	Min. 30 Secs—Max. 90 Secs.
Maximum Peak Current (Low Voltage Rating)	6 Amps at 250 Volts
Maximum Peak Current (High Voltage Rating)	200 mA at 1 kV
Base Type	English 4-Pin
Operating position	Vertical

Price 12/6 each

Sockets to suit, 3000 Volt rating 5/1 each. Also suitable for many types of English photographic flash units. Wafer type sockets suitable for type DLS-10 unit. Each 2/11.
Hi-Speed 6-pin plug-in type keying relays 11/6 each.

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ELECTRONIC INDUSTRIAL AIDS

Although industrial electronic devices are not the immediate concern of radio enthusiasts, they represent an intriguing application of familiar principles. This series of articles contributed by Aerovox engineers, explains some of the better known applications.

THE vacuum tube or "valve", as originally developed for comnunications purposes, was expenive, unreliable and mechanically rail.

All these shortcomings have proressively been reduced till the acuum tube is readily acceptable vherever its peculiar properties can e put to advantage. No longer is it omething used exclusively for transnitting and receiving.

Now, of course, the transistor is romising to displace the vacuum ube from some of its applications, ut this represents largely a refinenent of the electronic approach.

Ultimately it will make possible nore complex yet even smaller deices to control machinery, transort, weapons of war—in fact almost very department of modern life. The vhole subject, indeed, is becoming o vast as almost to be bewildering.

ADVANTAGE OF TUBE

The leading advantage of the tube ver any form of mechanical relay ies in the former's extreme power ensitivity. Moreover, the tube's deendence upon electronic action ather than mechanical motion makes t less liable to the common vagaries f mechanical devices.

Tubes have no contacts to stick, noving parts to become noisy and e retarded by inertia, nor pivoted nembers to be disturbed by external ibrations.

Consequently, they are often more eliable in operation and more ruged than electro-mechanical devices n spite of their reputation for deliacy.

But the diversified electronic relay s not the sole industrial adaptation f the vacuum tube.

Various tube circuits designed riginally for radio communication, nd a few developed specifically for ndustrial purposes, form the basis f measuring instruments and conrol devices in industries far beyond he speculation of their inventors.

The tube, condenser, and resistor re faithful workers in many factories.

WIDE USE

Today, the layman has first-hand amiliarity with numerous applicaions of the vacuum tube outside of adio. The tube frequently joins ompany with the photoelectric cell, nother electronic device, to perform ommonplace tasks in modern, veryday life.

The cell-amplifier combination orms the brain of automatic speed raps on highways. Vacuum tube osillators spot metal objects in the ockets of employees passing through he exit doors of factories; and, in he service of police, betray conealed weapons on suspected perons.

Photoelectric burglar alarms have been commonplace for more than ten years, and so have photoelectric devices that protect the operators of maiming factory machinery.

The photocell opens doors for traffic through public places, and sound-actuated relays and amplifiers open garage doors when waiting motorists sound their horns.

The hard-of-hearing are aided by miniature pocket amplifiers, and medical science finds increasing worth in diathermy and short-wave therapy.

SPECIAL DEVICES

However, it is the application of the vacuum tube specifically to industrial operations other than the manufacture and testing of radio equipment that is not so commonplace, although of increasing instance.

The demands imposed upon electronic devices by various industries have been justifiably stern and it is gratifying at this time to observe that the tube, condenser, and resistor have made good in a number of industries too numerous to list completely.

In this series of articles, we will enumerate some of the outstanding industrial applications of electronic devices and explain the basic principles underlying their operation.

THICKNESS

Weight and thickness are being determined very precisely by instruments which make use of tubes and associated radio circuit components.

Figure 1 illustrates the principle of one system for determining the thickness of non - conducting materials.

Operation of this circuit is based upon the variation of condenser capacitance directly with the dielectric constant of the material between the plates and inversely with the thickness of the material.

The apparatus employed for this measurement is essentially a beat-frequency audio oscillator. It consists of two r.f. oscillators (one fixed; the other tunable) and a mixer circuit which delivers an audio-frequency voltage of frequency (corresponding to the difference between the two oscillator frequencies) to an indicator.

The latter is at zero when the two radio frequencies are identical.

The sample-testing "head" consists of two condenser plates, T1 and T2.

Both are rigidly mounted, but T2 is stationary and T1 movable, in order that the spacing may be altered for various samples when desired. The sample material, S, is placed between the plates.

HEAD CONNECTION

The head is connected directly across the tank circuit, L-C, of a highly stable tunable oscillator, and the r.f. voltage delivered by this variable oscillator is mixed in the demodulator (mixer) stage with r.f. output voltage from the fixed oscillator.

The fixed oscillator is often a standard-frequency crystal stage.

Any difference in frequency between the two oscillators will show up as an audio beat-note voltage which is delivered by the demodulator to the indicator. The latter may conveniently be an AC voltmeter, electric eye, or indicating audio frequency meter.

Before testing a sample, the instrument is "balanced" with no material between the test plates by

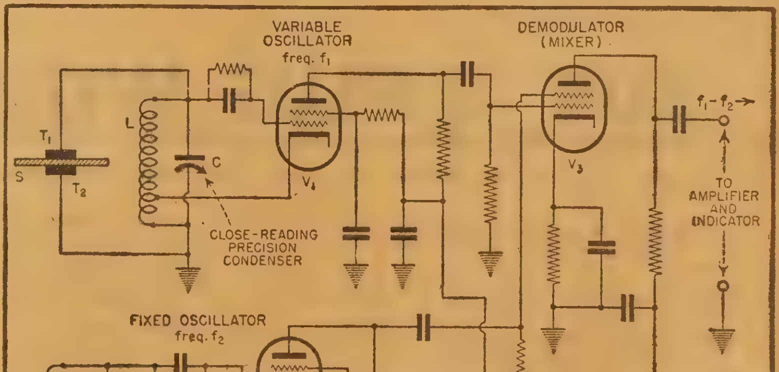

FIG.1

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setting the variable oscillator to zero beat with the fixed oscillator fundamental frequency or one of its harmonics, as shown by zero beat at the indicator.

When the sample is introduced between the plates of the measuring head, the capacitance of the condenser, T1-T2, will be altered in proportion to the thickness of the sample, and the amount of retuning of the oscillator condenser, C, necessary to restore zero beat is an indication of this thickness.

The dial of the tuning condenser may therefore be graduated in fractions of an inch or fractions of a centimetre.

Since the capacitance of T1-T2, when the sample is inserted, will depend upon the dielectric constant of the material as well as its thickness, measurements which will involve no computation can be made only on samples for which the dielectric constant is known, is consistent for all samples of the material, and for which the circuit has been compensated.

This is particularly important to remember when, as in the case of paper, long lengths of the sample may be kept passing continuously between the measuring plates during production.

WEIGHT

A similar basic arrangement for the determination of weight is shown in Figure 2. The same electrical circuit as Figure 1, embodying fixed and variable oscillators, is used here, the main difference being that the head is arranged in a slightly different manner.

The bottom plate, T2, is rigidly secured, while the plate, T1, is movable vertically and may carry a weighing pan.

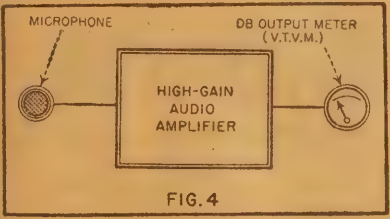

FIG. 4

The oscillators are set to zero beat with the pan empty. When, subsequently, a sample is placed in the pan, its weight will reduce the plate spacing proportionately and shift the variable oscillator frequency.

As in the preceding applications, the amount of retuning necessary to restore zero beat is an indication of the weight of the sample. The dial of the tuning condenser, C, may therefore be graduated in weight units.

Weights of exceedingly small magnitude are determined very previsely by this heterodyne method.

A circuit arrangement which eliminates the painstaking retuning operation and will show an increase or decrease in weight or thickness around a predetermined value is shown in Figure 3.

DEMODULATOR

Here the demodulator drives an indicating audio frequency meter. The circuit is balanced initially first by setting T1 and T2 to a separation corresponding to the predetermined weight or thickness and then setting the variable oscillator for a beat-note frequency at mid-scale on the indicating meter.

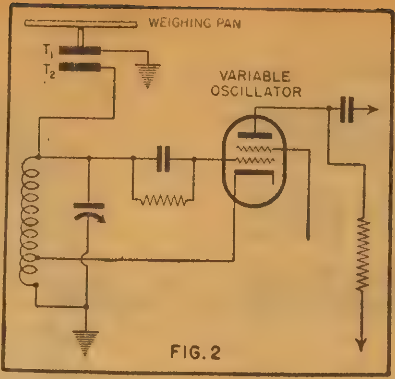

FIG. 2

The variable oscillator must operate on the high-frequency side of the fixed oscillator frequency.

Assuming a steady value of dielectric constant, a positive deflection of the meter will then indicate greater than desired thickness or less than desired weight. A negative deflection will indicate less than desired thickness or greater than desired weight.

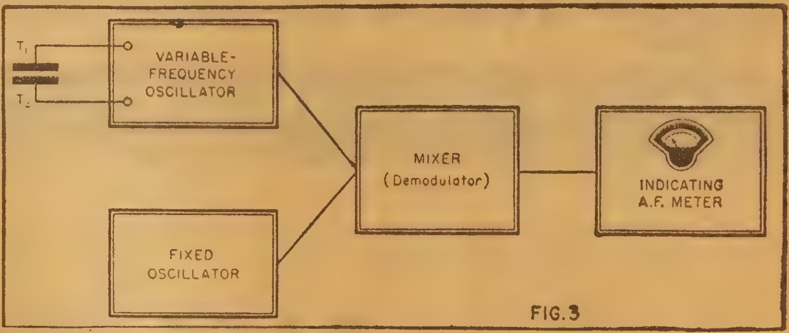

FIG. 3

The indicating meter may be replaced with a suitable recorder to obtain a continuous record of variations in thickness of a sample.

With either of the systems just described, it is clear that an error may be occasioned by temperature changes which act to change the initial plate separation.

For this reason, the temperature-capacitance coefficent of the measuring head must be known very accurately and used to correct all figures obtained by the measuring process.

STROBOSCOPE

The unaided eye cannot follow the gyrations of rapidly - moving machines. Because of this physiological limitation, accurate diagnoses of mechanical troubles have hitherto been hampered by the inability to make observations under actual operating conditions.

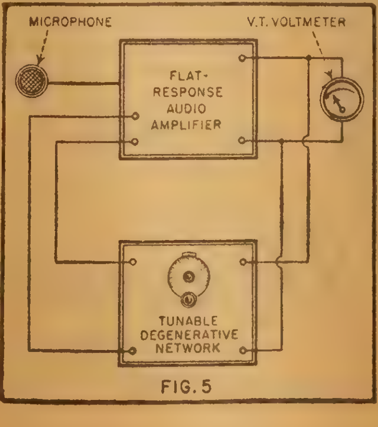

FIG. 5

But again the electron art has come forward with a useful tool—the stroboscope. Under stroboscope lighting, a rushing machine may be made apparently to stand still or to go through the antics of a slow-motion movie while the movement of any of its parts is studied under dynamic conditions.

The stroboscope operates by intermittently illuminating the moving object at the rate of the latter's movement.

"STOPS" THE ACTION

The object is accordingly viewed under rather strong illumination at regular timed intervals. Each flash brings the moving part into view in the same position as when illuminated by the preceding flash.

When the flashing speed lags behind that of the moving object, motion will apparently be slowly in the direction of actual movement. When the flashing speed is higher than that of the machine, a slow movement apparently takes place in the opposite direction.

When the flashing rate coincides with the actual speed of movement, the object appears to stand still.

The early stroboscopes used a mechanically-operated shutter to produce the flashes. The shutter was motor driven at controllable speed. The modern stroboscope is a flashing lamp instrument developed by Edgerton and Germeshausen.

The electronic stroboscope, like its mechanical predecessor, depends upon persistence of vision. By the optical illusion of arresting motion, it makes possible the study of moving machinery, determination of speed without attaching instruments to the moving parts, and similar observations.

It may be used to study any recurrent motion visually. Any non-repetitive motion may be studied photographically by means of single-flash pictures.

BRILLIANT BUT SHORT

Stroboscope flashes are very brilliant and of a few microseconds duration. They must be very short in order that the eye will discern no motion of the object.

They are produced by a lamp filled with rare gases (principally neon) or mercury which possesses the ability to be ignited and extinguished at high rates of speed. The discharge of a capacitor flashes the lamp.

The flashing speed frequently is controlled by a multi-vibrator type of tube oscillator. Typical stroboscopes provide flashing speeds up to

This design ensures . . .

SPECIFICATIONS

Resistance Values. Available in all standard values between 5 ohms and 10,000 ohms, 2 watt rating.

Wattage in rotation. Mechanical rotation 295°. Electrical rotation 266°.

All shafts are insulated. Maximum operating voltage from any terminal to ground is 900 volts RMS at standard atmospheric conditions.

Dimensions. Diameter, 1¼ in. Depth from mounting face, $\frac{9}{16}$in. Shafts, ¼in. dia., ⅜in. bushing. Standard shaft length, 2¼in., from front plate to end of spindle.

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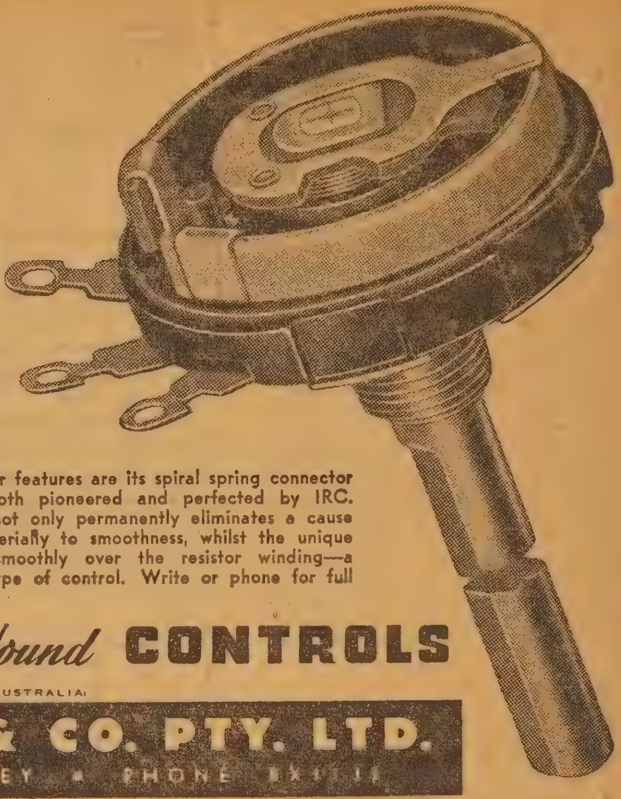

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14,000 per minute for visual observations, and up to 120,000 per minute for high-speed photography.

Because of the stroboscope's ability pparently to arrest motion when the lashing speed coincides with the speed of the moving object, it finds eady application as a very effiient tachometer which takes no power from the machine for its own peration.

For this application, the instrument dial which controls the flashng speed is graduated in revolutions per minute, and speed measurements may be made with an accuracy beween 0.1 pc and 1.0 pc.

The stroboscope is used in studyng rotations, vibrations, contact acion, torsion in shafts, whipping, lipping, chattering, bending, huntng, &c.

USE OF STROBE

It is employed in textile mills to check the speed of spindles, in automobile factories to study crankshaft whip and engine vibration, and in watch and clock factories in the adustment of the swinging balance wheels of timepieces.

Since it will reveal the condition of whirling samples subjected to cenrifugal force, structural engineers have found the stroboscope invaluable for testing and viewing stresses in reduced-scale building models, using controlled centrifugal force in ieu of gravity.

The stroboscope "slows down" paper rushing through a high-speed printing press in order that pressmen may correct the register in color printing without stopping the press and before a large number of prints are spoiled.

The superiority of the stroboscope in its numerous applications rests in the ability it affords to study the action of machine components while they are actually in their normal motion.

SOUND AND NOISE

Sounds and noises are of concern in industry for the reasons that they may indicate mechanical troubles or inefficiencies and they exert a pronounced influence upon the nervous health and efficiency of workers.

Likewise, the manufacturers of motor-driven appliances are eager to have their products run as quietly as possible and to this end devote considerable time to noise reduction programs.

The sound-level meter and the sound analyser are employed in the study and control of industrial sounds and noises.

Determinations of loudness and pitch not only enable engineering and maintenance crews to localise machine troubles at their outset, but also lead the acoustical engineer to the source of each sound tending to impair concentration of the attention, worker efficiency, and nervous stability.

SOUND-LEVEL METER

The sound-level meter aids materially in the reduction of unavoidable factory noises (such as those occasioned by the operation of presses, slapping of belts, rolling of trucks and vibration of heavy machinery) by evaluating in quantitative terms each step in noise-reducing operations.

This instrument reveals the actual noise level in decibels in accordance with standards adopted by sound engineers.

The sound-level meter is employed by various factories, builders, and acoustical engineers in the investigation of sound transmission and absorption in a number of materials.

A functional block diagram of a sound-level meter is shown in Figure 4.

It is seen that this instrument consists of a high-gain audio amplifier with sensitive microphone input and vacuum-tube output voltmeter. The microphone has uniform frequency response and the meter is graduated in acoustical levels.

Operation of the sound-level meter is notably simple. After easily-made preliminary adjustments, it is placed in the neighborhood of the noise to be studied and the noise level is read directly on the meter scale.

A functional block diagram of the sound analyser is shown in Figure 5. This instrument consists of a flat-response amplifier with a sensitive microphone of uniform frequency response connected to its input and a vacuum-tube voltmeter to its output circuit.

Between the output and input is connected a highly-selective tunable R-C circuit (degenerative network) which permits the amplifier to be tuned sharply to admit only one frequency at a time. The tuning covers the entire audio spectrum and is continuously variable.

The selectivity of the sound analyser permits it to be adjusted successively to the fundamental frequency of a sound or noise and to each harmonic of the fundamental.

It is essentially an audio-frequency wave analyser and shows the relative amplitude of each component of a complex sound wave.

The sound analyser and noise-level meter have been used extensively in the automotive industry to measure car noise and in developmental work directed toward quieter car interiors and quieter mechanisms.

The aeroplane industry employs both instruments in vibration measurements on engines and propellers. Railways study the internal and external noise characteristics of their rolling stock with these two instruments, and pure scientists have used the sound analyser for study of supersonic sounds in nature.

In some industrial noise measurements, it has been desirable to employ the audio-frequency test oscillator, another electronic laboratory instrument, in combination with an amplifier and loudspeaker, to induce vibrations in machines and parts to identify disturbing resonant frequencies.

TO BE CONTINUED

WHAT READERS HAVE TO SAY . . .

A NEW READER

AS a new, but already ardent, reader of Radio and Hobbies, I wish to express my appreciation of the way in which this most informative and interesting magazine is published.

A mere novice in the radio field, I have been forcibly struck with the able manner in which the many articles are written and, despite lack of knowledge on the subjects discussed, I have found it quite possible to follow, if not the technical points, the general theme and implications.

Of particular interest to me was the story of radio valves commenced in your June, 1952, issue under "Here's Your Answer, Tom!"

The breezy narration, while holding the interest, covers much informative material, and the simplicity of presentation is such that even a dullard must have a reasonable conception of the subject matter after the first reading.

A complete radio course presented in like manner would be a "wow".

While I have singled this article out for special mention, let it not be thought that my reaction does not extend to the entire magazine, which, to my mind, should be published at least weekly.

—J.H. (Warwick, Qld).

COUNTRY ENTHUSIAST

AS a country schoolteacher who likes his records well-produced, I can offer at least one useful suggestion to the reader who is building Mr. Findlay's battery-powered "Playmaster", featured some months back.

Since microgroove records were released, I have been able to play them in areas without AC mains.

In my schoolroom I have one of those splendid old Edison disc-record spring motors which is capable of a steady 33 1-3 rpm, although not originally designed for this speed, and I am sure that numbers of these old motors must be lying unused in garages and second-hand shops. This is operated with a small vibrator amplifier, Acos GP-20 and 10in speaker, and results are at least comparable with a commercial radiogram.

At home, 100 miles away, which I visit whenever I can get away from my school, I have my disc-recording equipment, built originally in 1946, though considerably modified since.

This gear is operating, through a commercial vibrator-inverter, from 240 volt DC mains, and with the current model "Royce" Senior Traverser, is cutting splendid microgroove discs at 300 t.p.i. The amplifier circuit is a four-input-channel affair based on a design published in Radio and Hobbies in 1948, and, of course, modified somewhat since. Valves are 2 6J7's, 4 6C8 twin triodes, and 2 triode-connected 6V6's. (Original design used 807's.)

For playback, output feeds to a Rola speaker mounted in an open-pipe enclosure, a bulky affair, but capable of excellent results. It certainly looks imposing, being more than 6ft high.

By the way, when operating from an inverter, the usual commercial synchronous, shielded pole for squirrel cage AC gramophone motor runs very smoothly, generating far less heat in its windings than when operating direct from AC mains, and does not require any ballast series resistor.

The frequency control of these inverters is very good, though very careful hum filtering is necessary in amplifier power supplies running from them.

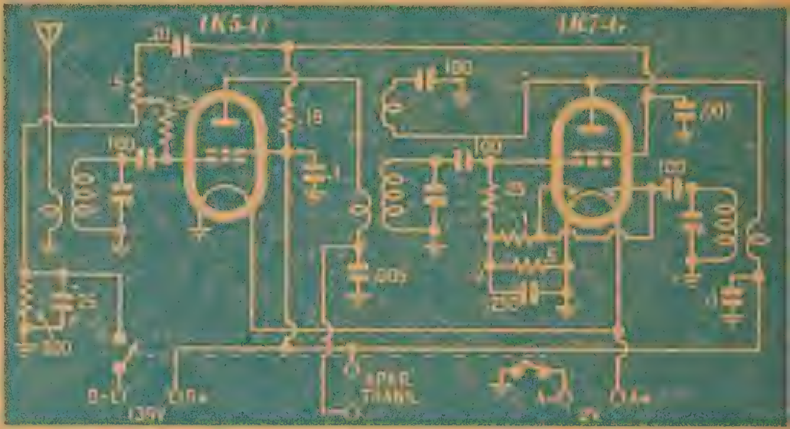
Thank you for the many enlightening articles on all types of recordings which you have published over the years.—D.M. (Wickepin, WA).

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

2-VALVE REFLEX BATTERY SETS WITH EXTRA GAIN

It's some time since we have delved into battery-operated reflex circuits. Here are two designs from an ardent follower of reflexing who infers that while they may not have much practical application commercially, they should prove of interest to home constructors who like to get the most out of few parts.



OUR contributor is Mr. O. Wallace, of Pacific Highway, Slacks Creek, Queensland. The first circuit at the right uses a 1Q5GT in a combined RF amplifier and power output stage with a 1K5G as a regenerative detector.

The operation of the circuit is as follows. The aerial is coupled to the RF amplifier grid through the usual aerial coil. The RF signals are amplified in the normal manner and passed on to the regenerative detector through an RF coil with reaction winding.

The regeneration takes place between the grid and screen circuits and the demodulated component passes into the anode circuit to appear across the .1 megohm anode load. The 250 pf bypass at the anode and the .01 megohm resistor are RF decoupling components intended to keep RF from being fed back around the circuit with the desired audio component.

The audio is fed though the .01 mfd coupling capacitor back to the grid of the 1Q5GT in series with a .2 megohm isolating resistor. The grid of this valve has a DC return to earth through the .2 megohm, the .5 megohm and the 1000 ohm back - bias resistor connected between B minus and chassis. It is thus biased for both audio and RF by the DC drop across the 1000 ohms. The 100 pf at the grid prevents the coil from shunting both the DC and audio components while passing the RF component.

As to be expected, the .2 megohm has some slight effect upon the selectivity.

The 1Q5GT now acts as a conventional power output stage delivering the audio to the primary winding of the output (or speaker) transformer connected in the anode circuit. The presence of the primary winding of the RF coil and the .005 mfd RF bypass has negligible effect upon the audio component.

SHIELDING

It is logical that some care must be taken to avoid unwanted coupling between various parts of the circuit. To this end our contributor recommends that the detector section should be well shielded from the aerial circuit. This may well mean the shielding of the valve and its associated gang section. The detector wiring should be kept as much to itself as possible with a view to laying a shield plate between portion of it and the rest of the wiring.

Mr. Wallace says that a 1L5G or a 1Q5GT seems to be just as good as the 1K5G. He also tried a 3S4. The 1K5G works quite satisfactorily as a detector with only 1.5 volt on the filament but it would not be very successful in the first stage for audio output.

Similarly, the IL5G would do better in the output stage if it had the full 2 volts on the filament. The 1Q5GT, of course, has a filament rating of 1.5 volts.

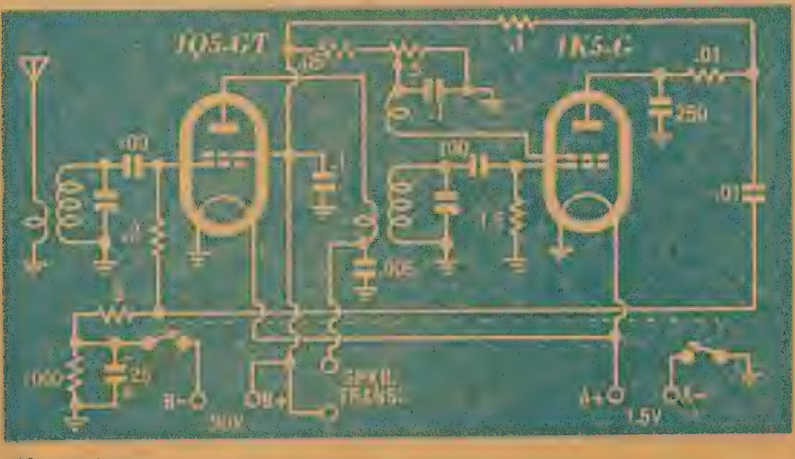
The high tension should be limited to 90 volts for the 1Q5GT but may be higher if the 1L5 is used. In such a case, the filament should preferably be 2 volts.

The second circuit differs from the first in a number of respects. It has in effect an extra stage. The RF signals are amplified in the 1K5G and again in the 1K7G regenerative RF stage. They are then passed on to the 1K7G diodes for detection and development of AVC voltage.

After RF filtering, the remaining audio component is fed to the grid of the 1K7G in which the grid screen Gm provides some amplification before it is passed on to the grid of the 1K5G which now acts as an output valve. The grid of this valve is biased by returning the "lower end" of the volume control to the 500 ohm back-bias resistor.

As before, shielding between the aerial section and the 1K7G wiring and components is very important in the interests of stability even to the extent of including the appropriate gang sections within the shield around the 1K7G.

Our contributor recommends the use of 135 volts HT if you want to get the best out of the set.



TRADE REVIEWS AND RELEASES

RCS RELEASE KIT FOR ANTI-NOISE AERIAL SYSTEM

Latest release from RCS Radio is a complete package anti-noise aerial kit, which comes ready for immediate erection. It retails through distributors for £7/-/-.

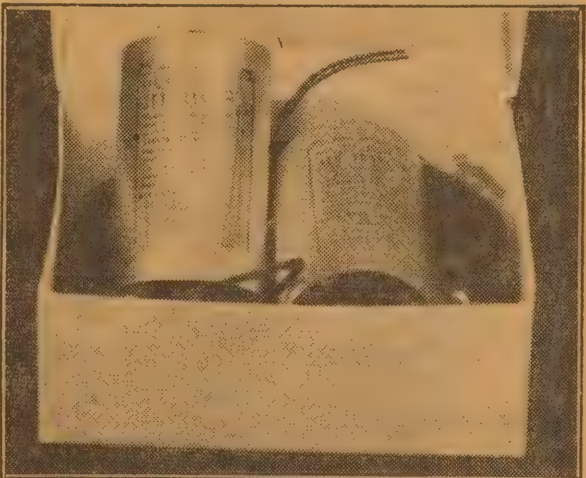
HE kit is designed along well- proven lines and relies on the a of confining the signal pickup far as possible away from the mediate vicinity of street frontes and power wiring.

The aerial is erected in a clear ice, and as high as possible, the nal being fed directly into a stepwn transformer hung from one rial support wire. The signal ergy is then carried through a in, lead to a second transformer unted near the receiver. The rial return system and the receiver elf are then earthed.

nterfering signals present in the nestic wiring or in the vicinity the set do not penetrate the sys- n to any extent.

Two aerial systems of this type in use in the city building hous- Radio and Hobbies offices and ry relatively noise-free signals m the roof to our laboratory in the centre of the building. We used heavier cable throughout, however, to withstand the heavy winds in such a situation.

RCS are also offering a range of line filters for use with various domestic appliances, where these are known to generate noise.



The RCS aerial filter comes complete with instructions in the lid. The makers claim that the coils are proofed against normal weather hazards.

★

AKER 15w. "TRIPLE CONE" SPEAKER

Illustrated on the right is a fifteen watt Baker speaker which is now available through some trade houses and from Simon Gray, 28 Elizabeth St., Melbourne.

IE speaker is described by the makers as a "triple cone" unit, hough the reason for the term is immediately apparent. It is nted out, however, that a central minium disc, while serving as a t cover, is also an efficient radiag surface for high frequencies. s claim appears to be borne out l in practice.

he main cone is also of unusual ign. The inner portion follows mal curvilinear practice and is cially stiffened to form a second e. The outer portion, however, ves beyond the horizontal, and is pended at the edge by a soft h.

his method of construction re- s in a low bass resonance, actu- about 35 cps.

he manufacturers quote the voice impedance as 15 ohms, the flux sity, 15,000 lines per sq. cm., the frequency response as 18 to 00 cps.

et up in a large vented enclosure, speaker immediately impresses n its clean bass response, as ht be expected from the low e resonance. The frequency re- nse obviously extends well into treble register, conforming to t one would expect of a speak- n this class.

here seemed to be some relative ntuation of frequencies in the Kc region, possibly at the ex- se of efficiency at the extreme t of the range. Reaction to the rall balance will inevitably vary, ever, with individual listeners. etail price is quoted as £26/11/-.

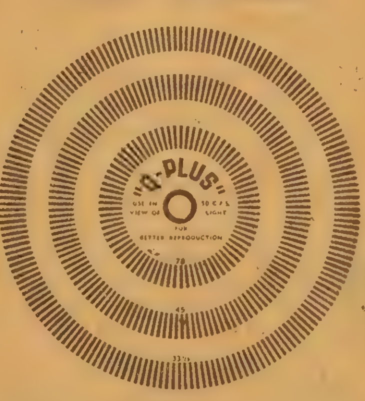
ELMEC TAPE HEADS

DURING the month, we were able to wire temporarily into a deck, two Elmec heads, as reviewed last issue in these columns. The heads (both half track) conformed to the maker's claim of being non-critical as regards bias and erase voltages. Good recordings were made and erased immediately without any adjustment to the circuit. A quick check indicated that the response was flat from at least 100-6500 cps but time did not permit the application of special compensation to discover the practical extremes of the range.

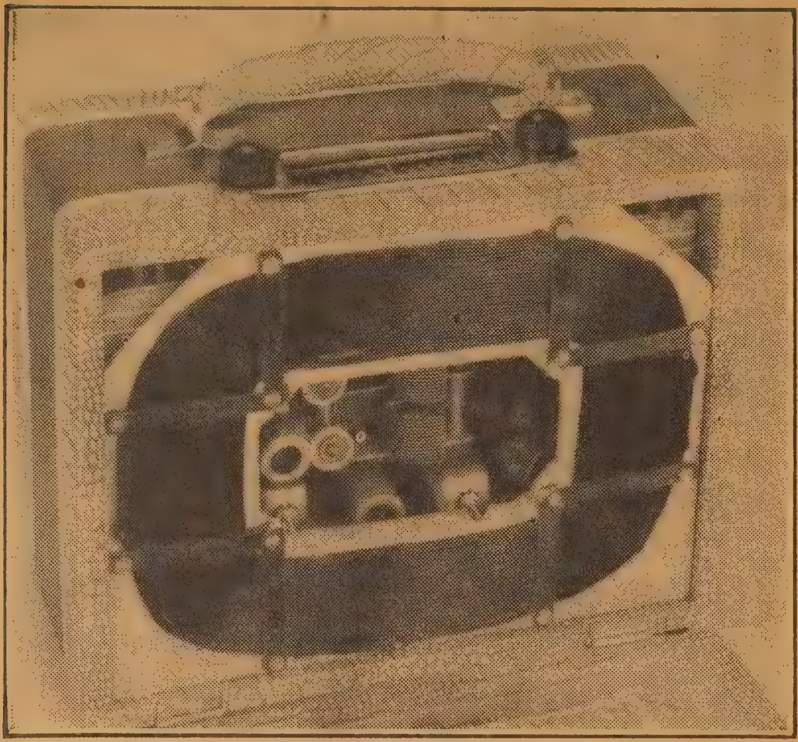
NATIONAL SAFETY-LITE

TO avoid the attendant risk of shock from regular 240-volt lead lights, Radio Parts Pty. Ltd., of 157 Elizabeth St., Melbourne, have released the National Safety-Lite. A 32-volt step-down transformer feeds the light through 24 feet of cable, the transformer itself being located near the power point and earthed through its 3-pin plug. The globe is protected by a wire guard, with light shield. Available through radio and automotive supply houses, the unit sells for £6/10/- complete.

FREE STROBO



Illustrated above is a 3-speed stroboscope which Messrs. R. W. Steane are offering free through all their regular distributors. For use under a 50-cycle light, it will indicate correct speed for 33, 45 and 78 rpm turntables. The reverse side is a price list for Q-plus coils. The strobo. card can also be obtained by writing to Messrs. R. W. Steane, Eastern Place, Auburn, Vic. Enclose a stamped addressed envelope to accommodate the 6-in circular card.



A rear view of the "Rambler" portable with the hand-wound loop in position. The "weld" marks across the PVC insulation do not show because the loop was turned over after assembly to hide them.

MORE ABOUT RAMBLER PORTABLE

During the month, we have been able to do some further work with our new "Rambler" portable. As a result, we can tell you how to wind up your own loop aerial and obtain from it a really good performance. A circuit is given for an AC power supply and, for good measure, some ideas on reactivating the batteries.

THE set, as described last month, used a standard commercial loop which for the sake of convenience was modified somewhat. We shifted the loading coil to a vacant spot on the chassis and cut away the centre of the bakelite disc supporting the loop. This allowed sound to issue from the rear as well as from the front of the cabinet.

Needless to say, the scheme worked out very well indeed, the bi-directional idea being particularly effective.

LARGER LOOP

However, we could not help but remember the performance we got from the original Senior Portable when we wound up for it a specially large loop. We knew that much the same would be true of the Rambler if a loop were designed for it to occupy all the available space.

Commercial coil manufacturers obviously cannot be expected to wind loops to suit every shape and size of cabinet on the market. Loops are expensive things to make. They therefore have to adopt a shape and size which will find the widest possible application—and it can't afford to be too large.

Furthermore, it is essential to provide a means of varying the overall inductance so that the loop can be made to track with standard coils. The most practical scheme for a mass-produced product appears to be the loading coil idea, whereby portion of the resonant circuit is lumped into a small litz-wound coil provided with a variable slug.

Adjusting this slug varies the total inductance of the combination, thereby duplicating the function of slugs in the other coils. (One has only to note the effect of this adjustment at the low frequency end of the band to appreciate the importance of correct tracking.

At the same time, however, a constructor who is prepared to wind a complete loop to the maximum available dimensions and to vary the inductance by cut-and-try methods will end up with more turns of larger diameter and a very much better signal pick-up.

In the original set, substitution of a hand-wound loop for the smaller commercial job brought about a marked improvement in loop performance. Country stations which were audible to moderate from our city office in daylight came up to overload strength with the volume fully advanced. We could hear regional stations in the background which were not even audible before.

With a separate aerial and earth, of course, there may not have been anything to it. It's a matter of assessing your requirements and deciding whether the added loop performance will justify a few hours of a rather tedious work.

LOOP CONSTRUCTION

To make the loop we first cut out a piece of 3-16in ply, as indicated in the last article, to be a neat push fit into the back of the cabinet. We trimmed off the top corners to clear the catches and cut a section from the centre to avoid blocking the rear speaker port.

But for the corners this opening approximates a rectangle measuring 4¾ x 2¾ inches.

Next job is to cut four angle strips from thin bakelite, with arms 3-8 to ½ inch wide and 2 5-8 inches long overall. Drill holes in the bakelite 2¼ inches apart and mount as indicated on the plywood board. Place a thin bakelite washer under the apex of each arm and attach the arms for preference with plated or copper rivets.

The four inner rivets make convenient anchor points for grid, AVC, aerial and earth connections.

The outer rivets must not be put in, of course, until the loop is completed.

To wind the loop you will need approximately 25 yards of 7/.010 PVC hook-up wire, or bellwire of equivalent diameter. Anything thicker would not be satisfactory by reason of the extra bulk.

PRIMARY WINDING

Begin by winding on three turns for the aerial primary, terminating the ends on two rivets. Then solder the end of the wire to the next rivet preparatory to winding the secondary.

Before going any farther, clean the barrel of your electric soldering iron and file the solder tinning off the tip. For the next hour or so it is going to serve you as a "welding" too! for PVC insulation.

If you have bought the wire in a hank, stretch it all slightly to remove the kinks and let it lie in a loose coil.

After that you will find that you can wind on quite a few turns at moderate tension before the turns begin to slip and stack up under the bakelite at the corners. Once this begins to happen you have to begin using the iron.

Holding the turns flat against the ply, run the tip of the barrel of the iron across the insulation and then, while still hot, press the insulation together with your finger. It sounds rather crude, but you should be able to make a reasonable job of it.

Having thus secured the turns already wound, the rest generally have to be wound on part turn at a time, "welding" as you go. We developed the technique of holding a few inches of scrap plastic covering near the wire, patting little pieces of it on to the weld with the iron-tip.

Do this until you have wound on 32 turns, by which time the available space will be fully taken up.

SPACING WASHERS

Slip a small bakelite washer under the tip of each bakelite strip, pass a rivet through and spread the ends just enough to hold in place.

Actually you can make the loop look neater by slipping it off the board and turning it over so as to hide the weld marks. If properly done there should be no danger of it falling to pieces in the process. Make sure, however, that you keep the grid and AVC connections to the left as you look into the rear of the cabinet.

The loop can be used either way around, as far as wiring is concerned. Our original connections were: Inside primary to earth, outside primary to aerial, inside secondary to AVC, outside secondary to grid.

The chief objection to this connection, we found, was that the outside of the loop was sensitive to capacitance effects, the trimmer adjustment being dependent on having the loop very precisely in position.

Reversing the secondary but leaving one side of the primary still earthed overcomes this effect very largely, but adds enough capacitance to make the aerial circuit peak with the trimmer right out.

We finished up using the primary purely as a capacitive coupling, leaving the free end to float. This is done to at least one of the commercial loops. Actually any of the three methods are permissible, whichever one is most effective in your case. Remember, however, that the aerial trimmer must peak toward the high frequency end of the band.

AERIAL TRIMMER

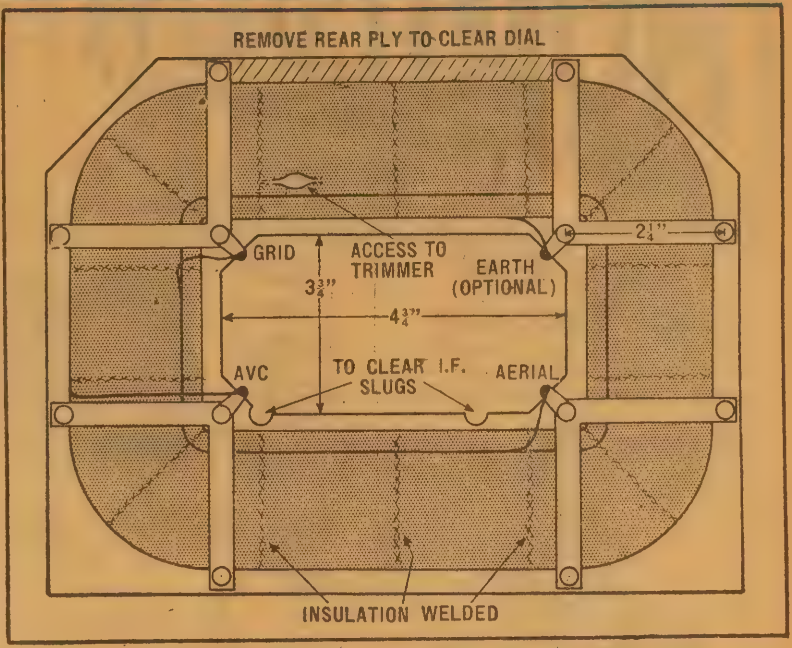
To peak the aerial trimmer, by the way, we cleared a space between a couple of the turns and drilled a small hole for a screw driver. A couple of slots had to be filed where the IF transformer slugs come close to the loop and a thickness removed from the top edge of the ply to clear the dial.

Actually the most critical adjustment is to the inductance of the loop, a property which is markedly affected by proximity to set and batteries.

Begin by aligning the receiver in the normal way, preferably coupling the input direct to the RF grid circuit, so as to nullify any effect of wrong loop inductance.

Having done this, instal the chassis and batteries in the cabinet and connect up the loop by leads no longer than necessary.

DETAILS OF HAND-WOUND LOOP



This diagram will help you assemble your own loop. Cut and fit the bakelite strips before you begin winding the loop, drill the holes and make sure that the plywood back fits into the rear of the cabinet.

Tune the receiver to a station toward the low frequency end of the band—the weaker the better—and orientate the set for maximum loop pickup. Now move the loop toward the set and note whether the signal increases or decreases in strength.

If you are lucky, it should increase in strength as the loop comes into its normal position. It indicates that the inductance is originally too high, but that it drops to the appropriate figure when close to the set and the batteries.

BECOMES TOO LOW

Bringing another metal plate or chassis close to the loop should lower the volume, indicating that the loop inductance does not need to be further reduced.

If, however, a reduction of the inductance by this means does increase the volume, remove a turn and try again.

Conversely, if the set volume decreases as the loop is pushed into position close to the set, it is clearly an indication that the inductance is too low and you will have to add a turn.

Having thus set the inductance, peak the aerial trimmer on a weak station with the loop in position and toward the high frequency end of the band.

We found that the tracking was not perfect but, by peaking the inductance in the 2FC region and the trimmer in the 2SM region, the tracking error was not serious elsewhere in the band. As already mentioned, any small discrepancies in this direction were more than offset by the pickup of the larger loop.

Coming to the matter of AC operation, the "Rambler" was deliberately designed to make this easy. The filaments were connected in series for 9-volt operation, so that the AC supply is merely called upon to deliver filtered output at 90 and 9 volts at a gross maximum current of about 62 milliamps — a relatively simple task.

The real problem occurs when the valve filaments have to operate in parallel, thereby presenting a low-voltage high-current circuit and a nett impedance so low as to be almost impossible to filter completely. We've had something to say about these problems before.

The requisite voltage and current can be obtained quite easily from a small power transformer using a choke input filter system and an ordinary rectifier valve. The degree of filtering using ordinary components is ample to prevent hum troubles from the filament and high tension circuits.

As a matter of fact, when planning the set, we were half inclined to design it as another self-contained AC/Battery portable. We decided against it, however, in the interests of simplicity and styling. It is intended primarily as an efficient, compact battery portable, for which you can easily provide an AC supply as a separate unit, if you so desire.

If, on the other hand, you are keen on the combination set idea, then the obvious answer is the "Jubilee" portable from the December, 1951 issue. The circuit is the same and, with a larger loop, there would be nothing to choose between the performance of the two sets.

As it is, the power supply included in the "Jubilee" is exactly right for the "Rambler" and, to verify its operation, we simply ran wires between the two chassis and switched on.

This was a blessing in a way, in a rather busy month, because it enabled us to carry out immediately

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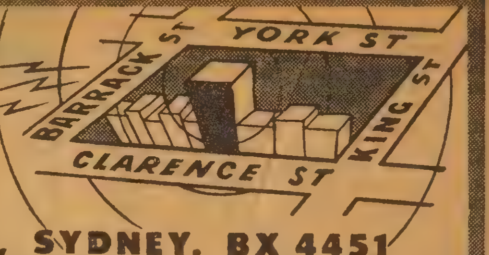

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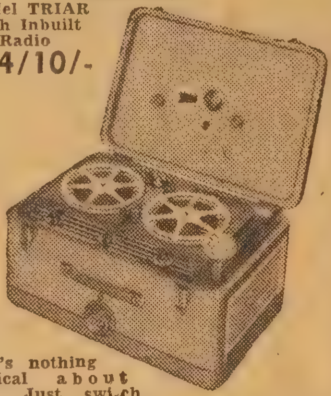

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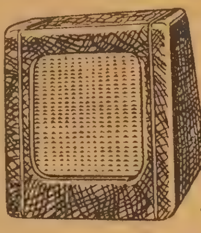

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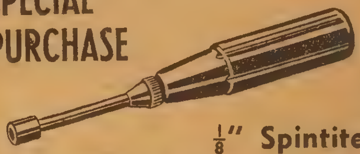

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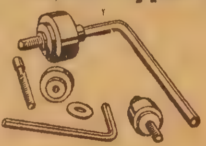

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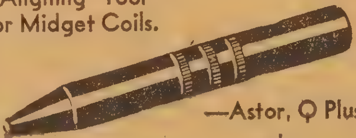

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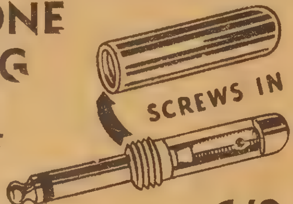

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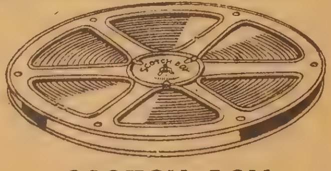

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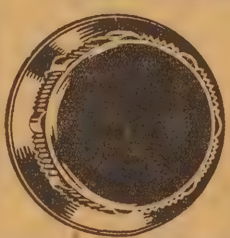

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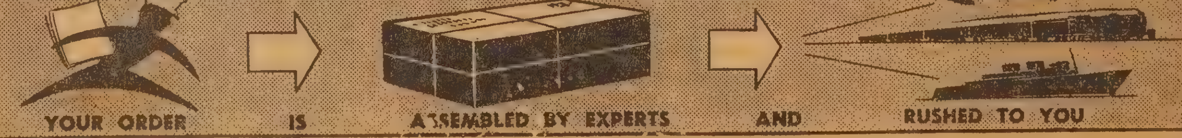
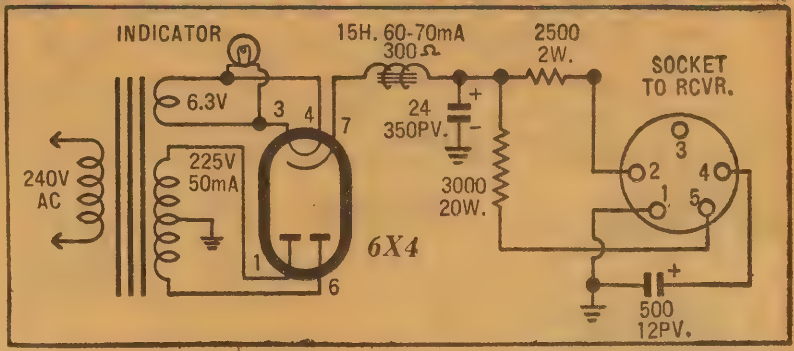


A-C SUPPLY FOR THE "RAMBLER"



Circuit of an AC power supply to suit the Rambler portable. It is essentially the same as specified for the Jubilee portable. See text regarding the choice of components.

tests on battery reactivation as well. However, time ran out before we could build a more photogenic type of supply and this will have to come later.

For the present, we must content ourselves with giving you the design information, leaving you to build it up in any way that suits you. Fortunately, layout is not likely to be a problem in a power supply.

As far as the actual set is concerned, it is necessary to make only one trifling addition—a lead direct from the filament line (pin 7 of the 3V4) to pin 4 of the battery plug. It virtually bypasses the switch.

When the set is used on batteries, there is no connection to this pin and everything functions as before. The rest of the story centres around AC operation and the power supply circuit itself.

POWER TRANSFORMER

The supply calls firstly for a 225 volt per side, 50-milliamp transformer. Because of the choke input filter, it can handle the extra few milliamps without distress.

Avoid substitute ratings unless you are in a position to redesign the circuit. When supplying the filaments of relatively frail battery valves, the voltage simply has to be right.

For the same reason, it is as well to use a 6X4 or 6X5-GT rectifier.

The choke is likewise critical. If the resistance is any lower than 300 ohms, the difference will have to be added to the 3000 ohm filament dropping resistor.

If the resistance is greater than 300 ohms (some small chokes go as high as 600 ohms) they will tend to heat up under load and will also necessitate a reduction to the 3000 ohm filament resistor.

Don't be perturbed if the voltage at the filament supply reads very high with the set disconnected. It will drop to its correct figure under load. For a mains voltage of 240 AC, the filament supply potential should be about 8.0 volts.

Best way to check matters at the first trial is to connect everything up and clip the multimeter to the filament circuit. Set the meter to the 10-volt DC range and switch on. The voltage will come up slowly as the rectifier warms up and you can switch off immediately if it looks like swinging past the 9-volt mark.

Add resistance to the filament circuit and try again.

HT SUPPLY

There should not be any worry about the HT supply, which should run out at about 90 volts under typical reception conditions.

Needless to say, the 3000 ohm resistor should be kept clear of the electrolytics because it becomes fairly hot after a few minutes' operation.

You will note that the 500 mfd filament condenser is connected straight through to the filament circuit. This arrangement prevents damage to the condenser should the supply be switched on without being connected to the set.

It also prevents the condenser from charging up to a high potential and then subsequently discharging through the filaments if connected to the receiver with the supply switched on.

Operating the on-off switch in the receiver will render it inoperative but the proper course when running the set from the mains, is to switch off at the power point. It might be a good idea to instal an indicator bezel on the supply so that there will never be any doubt about it being on or off. So much for the problem of AC operation.

Last but not least, we investigated the possibilities of reactivating the batteries from this same power supply.

Apart from the simple question of whether or not it could be done, we had to decide on the procedure to follow, the charging rate and the basis of estimating the charging time.

Suggestions for permissible charging current have varied from figures far in excess of the load current to "equal", "half" and "quarter".

We thought it best to be guided for the time being by the battery manufacturers, who suggest spreading the reactivation period over at least 12 hours.

To satisfy this suggestion in detail would involve a variable charging rate, depending on how much the set has been used just previously. To avoid this difficulty, we have translated their suggestion into known figures of current drain, likely periods of operation and, therefore, an acceptable "charge" rate.

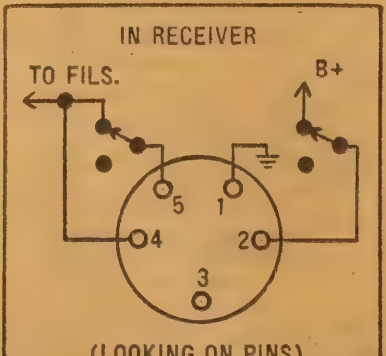
Thus, if one reckons on three hours per day of operation at say 12 milliamps, the total amp/hour load on the batteries is .036 AH.

If the charge must exceed the load by 50 pc, it will amount to approximately .054 AH. Spread over 12 hours, this involves a charge rate of between 4 and 5 milliamps.

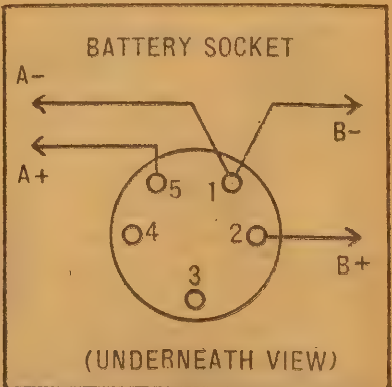
By the same process of reckoning, the filament battery requires a charge rate of just under 20 milliamps.

Working on this basis, one arrives at a rule of thumb whereby the batteries should be reactivated for a period equal to four times the period of use. Thus, if the set has been run on batteries for a total of about three hours in any one day, the batteries can be reactivated overnight, and so on.

We toyed with the idea of activating while the set was in operation but the available current is small and it is much more difficult



One additional wire is needed in the receiver, namely a lead from pin 4 of the battery plug on the chassis to the feed point of the filament network.



Connections to the battery supply socket are made this way. They ignore pin 4 which provides a means of connecting a filter condenser for AC operation.

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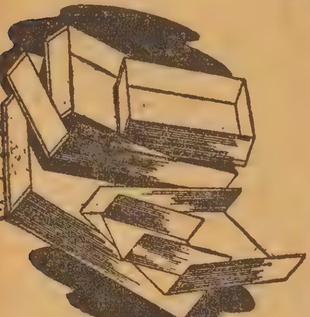

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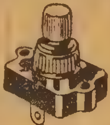

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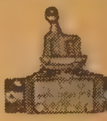

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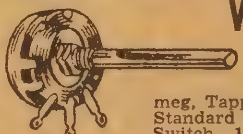

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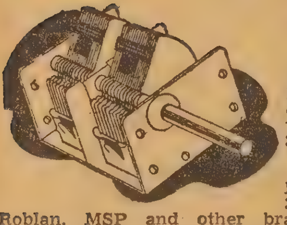

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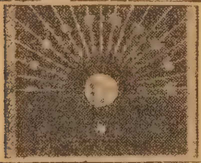

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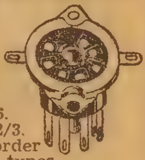

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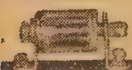

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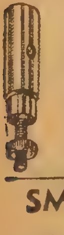
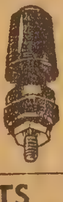


TERMINALS



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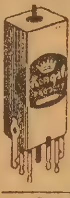

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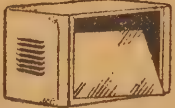

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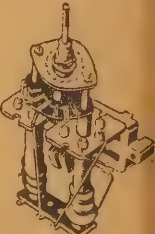

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to keep track of time. We decided, therefore, to incorporate in the power supply a simple switch which adapts it either for running the set or reactivating the batteries.

One problem, however, had us worried—what would happen to the batteries if they were connected to the activation circuit without the AC supply being switched on? Inevitably they would suffer a slow but damaging discharge.

To cut a long story short, we reckoned that the simplest precaution was to wire a 6H6 into the high tension charging circuit so that it would pass current from the supply and through the batteries as long as the heater was at normal temperature.

ELECTRONIC SWITCH

Without the heater energised, the valve becomes a virtual open circuit so that no current can flow. It therefore breaks the circuit that would otherwise exist across the batteries through the respective series networks.

With this point explained the operation of the circuit is clear enough.

In the "operate set" position of the switch, the circuit duplicates the simple supply shown in the previous page. The same remarks and precautions apply regarding choice of components, operating voltages &c.

In the "reactivate" position, the supply is disconnected from the receiver and fed through additional series loads to the batteries. The resistance values as shown are sufficient to limit the high tension charge to about 4.5 milliamps and the low tension charge to 19 milliamps.

By simple adjustment to the respective resistors, it is possible to vary these figures, remembering that the maximum permissible current for a 6H6 is 8 milliamps.

Our circuit as it stands should be very close to the mark but you can easily check it for yourself if a meter is to hand. There should be no current flow whatever through the batteries when the AC power is switched off. In this respect, our unit appears to be completely foolproof.

Physically, we envisage that the supply would be built on a small chassis and housed in a box to sit unobtrusively near the receiver. (Don't forget ventilation, however.)

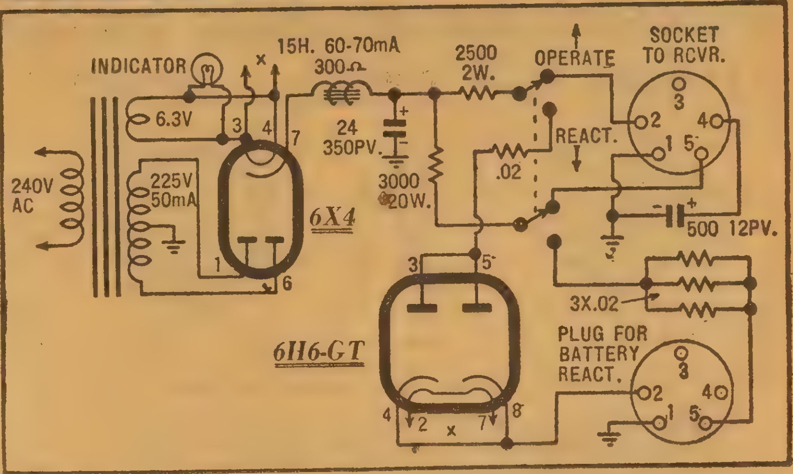
RECEIVER CONNECTION

It would have a power cord for connection to the receiver, terminating in a 5-pin Amphenol type socket with cover. The lead could be quite long, if need be, since the current flow is relatively small. This lead would simply plug on to the receiver in place of the batteries.

For reactivation purposes, the supply could be fitted also with a 5-pin plug, either let into the chassis or floating at the end of another cord. (Keep a cover handy, however, for the pins are "live" in the "activate" position.)

The 5-pin socket from the batteries is simply pushed over this plug and the activation process can begin. As we said before, it is simply a matter of applying power to the supply and switching it as required to "operate set" or "reactivate batteries".

A-C SUPPLY AND REACTIVATION



With this supply, you can operate the set from the power mains or, as an alternative, reactivate batteries after each period of use. The resistors in series with each battery control the reactivate current and can be varied if you are keen to experiment. The suggested values conform closely with recommended practice, however. The 6H6, which prevents accidental discharge, can be purchased ex-disposals for about 3/6.

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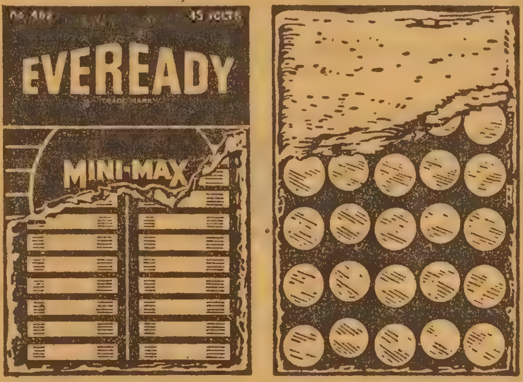

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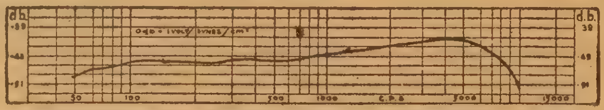

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LETTERS ON BUSHFIRE RADIO

All our correspondents have expressed approval of our intention to describe equipment suitable for home construction, and of our interest in bushfire radio in general. It seems likely that a channel through which ideas can find an outlet is something many have been looking for. If this is so, we are happy to provide that channel, with the intention of building up interest and giving guidance to those who need it. For instance one reader writes—

"IT is with pleasure that I've read the first of a series of articles in Radio and Hobbies on radio in bushfire fighting. I gather that in Victoria we are ahead of NSW in this respect. We use 22 frequencies in the 5 mc band and have over 300 transceivers, mostly modified service equipment. We use a loaded aerial on mobile which gives a much greater range than the usual 12ft whips—according to strength meters it is three times that of the whip.

"I gather that in NSW fire-fighting is run by the councils, while here it is a different matter with the Country Fire Authority and its regional officers to each rural and urban brigade.

"So I'll say keep up the good work!"

This man is interested in the political aspect of operating bushfire schemes in general, and an expression of opinion on this matter might lead to some useful thoughts for the future. It makes the point, too, that the procedure and control are not the same in each State. Perhaps we could all learn by finding out how each method works in practice and how it affects radio communication.

TECHNICAL SUGGESTIONS

Other letters have come in with technical suggestions for our own equipment. There is unlimited scope in this field for an exchange of ideas and a pooling of experience. We have selected part of a letter from another reader to illustrate this point:

"Firstly, let me say how pleased I am to read your article on bushfire fighting in this month's edition of your paper. Every area has its own problems, but the point that pleases me is the fact that you have seen the need to help us in this particular type of radio.

"I have recently changed to a (commercially made) set which is the best I've seen or heard. I have mine fitted up on the shelf at the rear of the seat of my utility. I can verify 25 miles mobile to mobile, but signals are regularly heard 60 miles away.

"All this is from a whip aerial. This is most important—please when designing your sets make them work from a whip. I can work mobile at 50 mph if necessary. We had a year using long aerials to be run out when necessary—it was a hopeless flop. They are all being converted to loaded whips this year, and are now 100 pc mobile.

"My set measures 10½ x 5 x 6½ inches and the power pack 6 x 7 x 4 inches. It has only a volume control and change-over switch, while the power pack has the master battery switch.

"The aerial consists of four sections approximately 12ft long, and has the loading coil fitted between the last sections. In other words the loading coil makes the join about three feet above the base and makes it possible to remove the aerial by unscrewing one screw. The loading coil is wound on a bakelite bobbin about 6 inches long. The ends are brass and fitted with holes to take the aerial section secured by two screws.

"A very important point is a lamp that lights when the transmitter is running and which varies with the amount of speech. It is most helpful to know when you are on the air.

"The transmitter is rated at 10 watts, which is sufficient, but we would not want less for whip operation. We are about to put in a base set of 20 watts, but personally I would like 30 or 40. . .

A FULL article describing a radio-transmitter for bushfire communication commences on page 54 of this issue, and will be followed by others in future issues. If you have some ideas you think will help us or other readers, write to the Editor about them. We won't use your name if you'd like it that way, but you might make some useful friends if we do.

"The equipment is crystal locked on both transmitter and receiver, best for most cases, although I would like to see a switch to lock the receiver in one position, with a second position to allow tuning. I would also like a built-in signal strength meter.

"I for one am particularly interested in what you have to offer us to build for ourselves. We do appreciate what you are about to do, let me assure you of that."

This reader is obviously a practical type, who has learned much under actual field conditions. And does he want plenty!

We have not published these readers' names because they did not know their letters would be published. From now on we will publish corerspondents' names unless asked not to do so. This practice might help to provide direct contact between many kindred spirits.

We are particularly interested in the subject of aerials, which is quite a problem in the field. It seems certain that some kind of whip aerial is necessary, for vehicles just can't rely on fixed aerials only. Even if they are not called upon to operate while in motion, their mobility does suffer if aerials must be erected before transmissions can commence. What have you found to be the best whip?

At the same time there is probably no whip aerial which can radiate as efficiently as a length of wire. Therefore, there is much to be gained by running out a quarter-wave aerial, for instance, where it is obvious that a vehicle is to remain stationary for some little time. We can generally arrange to put up quite good aerials at the base, but the weak link is to efficiently "hook the sky" from the mobile equipment.

What are your experiences here? The NSW Forestry Commission, for instance, always uses wire aerials with their pack sets, but their standard operating conditions are somewhat different from emergency fire work.

AERIALS AND PACKSETS

And what are your ideas about battery packsets? They are the obvious thing to back up the mobile jobs, and could even perform reasonably themselves over some distance with a wire aerial. But assuming they will be confined to short-range operation, are they worth while? We are thinking of working out a packset, but would like to have expressions of opinion before undertaking what is likely to be a fairly concentrated piece of constructional work.

If you have anything you'd like to say about our articles on bushfire radio, or some experiences you think will help others, write to us about them. You'll help us, too, to do what we can in furthering this important community work.

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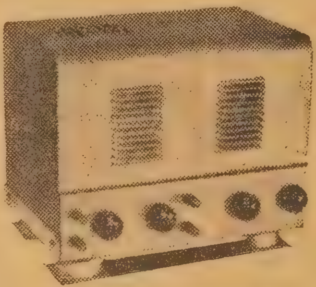

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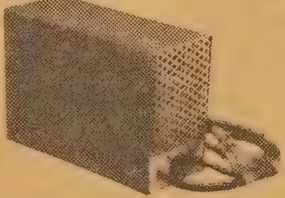

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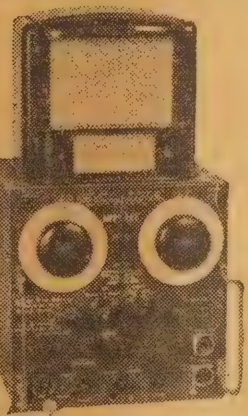

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OFF THE RECORD — NEWS & REVIEWS

By the time these notes appear, Australia will probably have seen the first locally-made 45 rpm records. It has been announced by the Australian Record Company that production on these records is about to begin and that we should see them soon under the Capitol label.

By JOHN MOYLE

THE records will cover the classical and semi-classical field, and are not intended to operate in competition with the large number of 78 popular records issued by this company. They will be of the extended-play type which have now virtually replaced the original 45 small disc which ran for about five minutes and 20 seconds. By the use of variable grooving, &c., the discs now contain up to about eight minutes of playing time.

The 45 records will have the large centre hole made necessary by the record changer for which they were originally designed. Although there are few of these changers at present in Australia, they may one dav become avaliable. In the meantime a small collet will be available to fill up the large hole and provide the normal spindle piercing.

ARC have virtually completed their move to a new factory at St. Leonards, where, according to Mr. Fegan, the managing director, he has some of the most modern pressing equipment.

NO MOVE BY EMI

No further mention of 45 records has been made by EMI, which is busy on the 33 LP records. It is understood, however, that there are some stocks of HMV 45's in Australia, which might be released before very long. Breaking the ice in the 45 field may stimulate some activitv from other record companies.

BEETHOVEN — Symphony No. 5 in C Minor, played by the Berlin Philharmonic Orchestra, conducted by Eugen Jochum. Philips, A00102L.

Unlike Neville Cardus, I have never been able to think of this symphony as "still in C Minor", despite some of the shocking performances I have heard. The truth is that this work is of such stature that rarely do we hear the occasion, the orchestra and the conductor get together to play it as it should be played. It is not only the greatest of the symphonies, but the most perfect and unique. It would be impossible to extract a bar without mutilating the entire pattern. It has much to say, it says with irresistible impact, and it ends at the inevitable moment in time and space.

MISSING IMPACT

This performance is an interesting one, and, at times, has great beauty, but it does not always achieve that sense of impact. It is idealised performance — at times almost pastoral —where I feel it should be more urgent. There are no pauses in the line of thought, but Jochum does not see it that way. He explores the music, intelligently and thoughtfully, but he does not bow to the iron will that impales the music, like a ramrod, from first to last.

This is perhaps more noticeable in the last movement, which is too urbane to shout as it should. On the other hand, he has produced a beautifully turned third movement, the battery of basses being particularly well handled.

Despite my personal reactions, I know there are many who dislike the Toscanini touch in such music, and I feel that in the milder manner, they will find much pleasure in this record.

The orchestra is of a high standard, the recording good but not brilliant, and the surface very clean and quiet. Probably the best all-round version I have heard so far.

HAYDN — Oxford Symphony played by the Residency Orchestra (The Hague) conducted by Willem van Otterloo. Philips, A00100R.

This, a charming record, brightly played with precision and vivacity. The only thing I didn't like was the break in the second movement to turn over. However, it would be hard to avoid without overstepping the 10-inches of the disc. The recording is quite good, and the surface very clean.

WESTMINSTER BATCH

Westminster's batch this month is rather an interesting one. I note with complete approval, the practice of sealing each record at the factory in a cellophane wrapper, which can be retained for storage. Not only does it protect the disc, but ensures that it will reach you in the same condition as it left the factory.

TCHAIKOWSKY. — Souvenir de Florence, played by the String Orchestra of the Vienna State Opera, conducted by Henry Swobada. Westminster WL5083.

This work is referred to on the jacket as "amiable" and that is as good an epithet as one might coin. In spirit it is far removed from the Tchaikowsky of the symphonies Cappricio Italien and Romeo and Juliet. It isn't particularly Florentine—there's too much of the composer's personal idiom to be heard. It is made from not very distinguished music treated pleasantly and freely but in the main with a rather heavy hand for only six instruments.

In fact, it is a wonder Tchaikowsky didn't score it for a full string orchestra and have done with it, for it is not "chamber music" in the accepted sense as applied to a septet. The last few bars are almost amusingly in the manner of a symphony in full close.

EXTRA TOP CUT

Some of the recording's rather thick atmosphere is probably due to the scoring, for its outlines are at times a little blurred. Here and there the upper strings are not completely clean for wide range, although I have found Westminster records can often do with more top cut than some others. On the other hand there are some really good sections to be heard.

The bass is well balanced, as for that matter are all the strings, and there is plenty of body in the music. A virile, imaginative performance makes a record which many will find most acceptable. Surface noise is very low.

SMETANA—Wallenstein's Camp—Symphonic Poem Op 14, played by the Vienna Symphony Orchestra (Swobada).

SUK — Fantasy for Violin and Orchestra Op 24, played by Peter Rybar and the Vienna Symphony Orchestra (Swobada).

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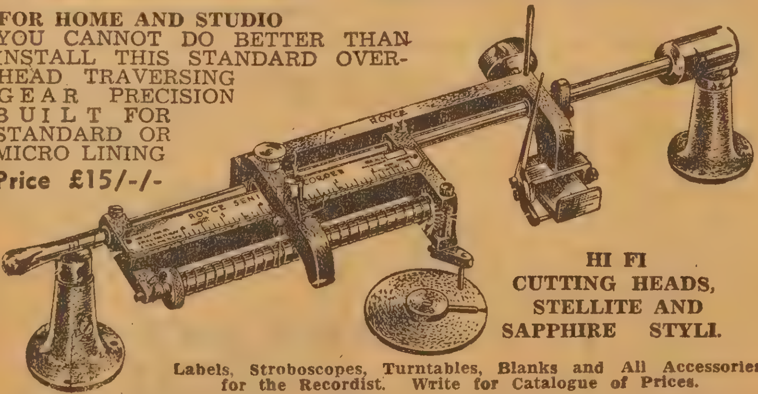

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These are both on Westminster WL-50-11 and it is an impressive record. It could easily be the most brilliant of the Westminster releases to date, for not only is the recording well and truly full range but the fine Vienna players are in their most dynamic form.

Both works were virtually new to me and they probably will be to most people. Smetana's poem was written as incidental music to Schiller's play concerning the Thirty Years War and refers presumably to Count Wallenstein. It is brilliant, atmospheric music of the grandiose, military style, replete with drums,, cannons, trumpets and, one might almost say, colored tunics. The collosal collection of brass, cymbals and the rest, together with the wild dynamics of the music, make really heavy demands on the recording, which nevertheless comes through in brilliant fashion. This record will test your gear from stylus point to neighbor's ears. The surface is good, but there are a few minor crackles.

A happy coupling with all this bravado is the tuneful and romantic fantasy by Suk, another Bohemian best known by his smaller lyric pieces which feature mainly as encores in concert repertoires. Probably the most striking feature of it is the vigorous and fiery violin part which gives Rybar a chance to show what a brilliant performer he is.

FINE RECORDING

The recording is remarkably fine — cleanly defined and balanced in he orchestra, and almost nerve-hattering in the forwardness of the oloist. I doubt whether I have ever heard better presence in violin recording, although not everyone will ommend the experience of hearing he bow biting into their ears quite o vividly. Truly we are getting hard o please these days, for apart from little streakiness in some of the oudest passages it seems ungenerous o criticise such vital recording. The rchestra maintains a similar stan-ard.

Surface noise is for the most part on-existent.

BEETHOVEN—Sonata In D Major Op 10 No. 3, Sonata In C Major Op 3 (Waldstein), played by Kurt pplebaum (piano), Westminster WL5044.

Two of Beethoven's finest piano onatas competently played by a ianist of imagination and considerble ability. Incidentally, there is n interesting contrast and com-arison between these two sides, in hich the early and middle period eethoven are so well represented. he extremely quiet surface throws he performances into almost deadly elief, although the recording en-neer has obviously kept his distance safely to avoid the tragedies which so often beset piano recordings. The D major sonata is the better of the two in this regard.

Nevertheless, the performance is not a perfect one . A rather extreme dynamic treatment invites occasional uncertainty in fingering, particularly in pianissimo passages, which should not be there in a pianist of rank. On the other hand, tonal effects are often very well handled. The least successful spot in recording is the end of the Waldstein, where the fates combine to present all concerned with a very hard job.

KODALY — Hary Janos Suite, played by the Austrian Symphony Orchestra conducted by Lazlo Halasz, Festival CFR10-98.

Hary Janos is the Hungarian equivalent of Till Eulenspeigel, a fairy-tale hero of fantastic adventure who was the subject of Kodaly's opera. This suite is made up of excerpts from it, written by a meticulous craftsman who knows the meaning of color. It is the kind of music which everyone will like—filled with humor and variety. It makes a most interesting study in orchestration, even if the dulcimer does sound like a modified piano.

Technically it is a fine piece of work—the best I have heard from this orchestra. Everything is heard —reverberation just right, nothing fluffed, range good in both bass and treble playing almost perfectly clean. This should be one of the most popular of recent ten-inch releases. Surface noise is inaudible.

RICHARD STRAUSS — Till Eulenspiegel's Merry Pranks — Don Juan played by the Concertgebouw Orchestra of Amsterdam. Philips A 00608 R.

A happy coupling of possibly the two most popular Strauss works, both full of life, color, and vigor — plenty of romance and swashbuckling on the one hand, and humorous fantasy on the other. Neither performance is as brilliant as I have heard, but they have plenty of life for all that. The conductor Jochum is the same man who conducts the Beethoven 5th reviewed earlier, and the same general touch is there. Another good record.

RAVEL — Quartet in F. Major played by the Budapest String Quartet Philips AO 1606 R.

A fine record, this, of one of Ravel's most graceful works. It has all the clear thought and charm which are so characteristic. One of those records which can be recommended to anyone who is getting used to "classical" music but who shies away from the term, particularly anything even mildly modern, although Ravel is hardly that today. The performance is by a quartet known the world over and I thoroughly enjoyed it. A good recording and a satisfactory surface.

SHOSTAKOVITCH — Symphony No. 9 Op 70 played by the Philharmonic Symphony Orchestra of New York, conducted by Efrem Kurtz, Philips A 01607 R.

Shostakovitch was the centre of much controversy a few years ago, but has emerged as an important figure, apart from any political colors. This symphony is a splendid example of his craftsmanship, his keenly etched reactions — a reflection of the modern aura if you like. It is music which I doubt could have been written a hundred years ago, for its mental outlook didn't exist then. The recording is good and I recommend it to you.

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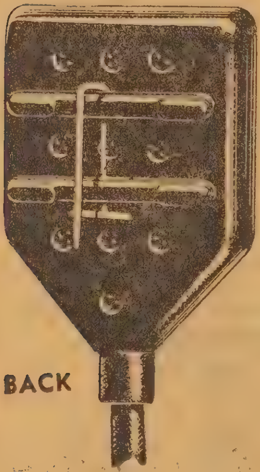

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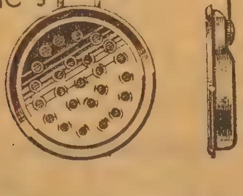

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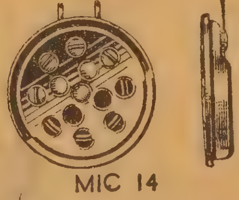

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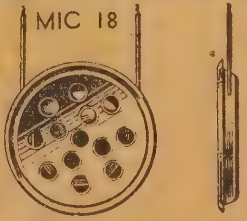

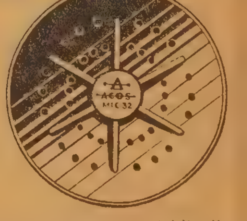

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HERE'S YOUR ANSWER, TOM!

he higher frequencies and grid nixing is often a worthwhile proposition. The receiver designer has o have experience in these matters before he is in a position to make a lecision.

Another converter system uses the ne pentode valve to perform both he functions of mixer and oscillator. t is known as the autodyne circuit. Because of several serious disadvantages and the availability of a umber of special highly efficient onverter valves the autodyne cir-uit is not used nowadays. You are nly likely to meet it in receivers nanufactured in the early 1930s.

Its principal disadvantage was the lifficu'ty in maintaining the oscil-ator circuit in operation. The slight-est bit of moisture in the coil would ower its efficiency so that the oscil-ator would stop operating. We can ecollect having restored autodyne eceivers to operation simply by aking the oscillator coil out of its an and baking it in the oven for an our or so.

The autodyne circuit is not suit-ble for short-wave operation and it loes not lend itself to gain control y varying valve operating condi-ions.

CLOSE COUPLING

Among other things the circuits so far mentioned all suffer from he disadvantage that the oscillator nd signal circuits are fairly inti-nately connected. Most of the nodern converter valves overcome his difficulty by injecting the oscil-ator signal into the electron stream nside the valve.

For this purpose an additional rid is placed between the grid and athode of the mixer valve and oupled to the local oscillator. So hat this grid will not have capaci-ive coupling to the signal grid a econd screen grid is placed between hem. Thus the injector grid is able o modu'ate the electron stream vithout interfering with the opera-on of the signal grid. The signal requency, the oscillator frequency nd the sum and difference fre-uencies all appear at the plate of ie mixer valve but usually only ie difference frequency is required nd is selected by a tuned circuit 'aced in the plate circuit. This ined circuit is coupled to the inter-ediate frequency amplifier.

Not only does this system have the dvantage that the signal and oscil-tor circuits are well isolated but scillator injection can vary over wide range without varying the erformance.

ALVE SERIES

There is a whole series of mixer lves employing this general prin-ple. Some have a small triode lve built into the same evacuated velope and using the same cathode the mixer section.

Each of the currently available ixer or complete converter valves as its own advantages which suit it r a particular application. Some, course, represent the ideas of a rticular radio organisation as posed to another organisation and practice both are perfectly satis-ctory.

There are a few representative pes which are worth remembering.

(Continued from Page 69)

The 6L7 is an example. It was about the first of the tubes to use electronic mixing to become generally available. Its general arrangement is the same as an ordinary RF pentode except that the screen consists of two separate grids mounted one around the other. The injector grid is mounted between the two.

The 6L7 requires a separate oscillator va ve, so for cheapness and compactness the 6J8-G, which is the same as the 6L7 but with a built-in triode section for oscillator use. The 6J8-G and its modern miniature counterparts, such as the 6AN7 and the 6AE8, are very popular with receiver designers.

Certain other converter valves use the grid between the two screens as the signal grid and the grid closest to the cathode as an oscillator grid. Examples are the 6A8-G, the 6K8-G and the 6SA7. The 6BE6 and the 1R5 are the AC and battery equivalents respective'y of the 6SA7.

With the 6A8-G the plate of the triode oscillator section consists of two rods, one either side of the cathode outside the oscillator grid. The oscillator grid thus serves the dual purpose of oscillator grid and modulator for the electron stream of the converter. The 6K8-G is similar except that the mixer section is constructed all on one side of the cathode. The oscillator plate takes the form of a flat plate which is mounted on the opposite side of the cathode. The oscillator grid is wound right around the cathode. The side nearest the oscillator plate serves for the operation of the oscillator and the opposite side modulates the electron stream of the mixer.

NO OSCILLATOR PLATE

The 6SA7 and the other types mentioned with it are similar except that they do not have separate oscillator plates. The first screen grid serves this purpose. Feedback for the operation of the oscillator is usually obtained by tapping the cathode into the oscillator coil.

In the case of the 1R5, no separate cathode is available. However, a feedback winding can be placed in series with the screen and plate. It offers small resistance to currents at intermediate frequency.

Your valve data book will give the exact operating conditions for the various types, Tom, which will help to expand what we have already said.

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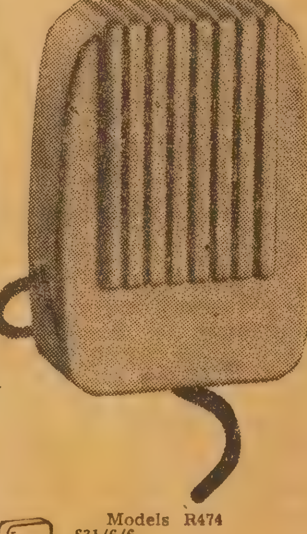

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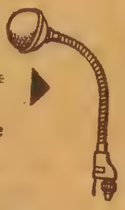

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SHORT-WAVE NOTES BY ART CUSHEN

FROM THE MAILBAG

YDB2, DJAKARTA, is the station we have been hearing on 4960Kc in the late evening, according to a verification just received from the station. YDB2 formerly operated on 4910Kc, and the frequency change, we presume, was to escape interference from VLM4, Brisbane. YDB2 operates 8.30-10.45 am, 2.40-5.15 pm, 7.30 pm-1.30 am, using 1Kw.

CE1198, SANTIAGO, CHILE, confirms reception with a folding card, showing photos of Santiago. CE1198 is the former CE173 operating on 11.735 Kc. CE1198 now uses 11.980Kc and is still being heard to sign off at 2 pm. Another Chilian has changed call, reports Radio Amateur. CEZ7C is now CE766 "Radio Yungay". Santiago, operating on 7660Kc. CE1190's verification is signed by Snr. Enrique Sanchez Matte, and the mailing address is Asilla 2626. The slogan, "Radio Sociedad Nacional de Minera" stands for National Mining Society.

RADIO EXCELSIOR, Apartado 1774, San Jose, Costa Rica, confirmed our reception of the broadcast on 6500 Kc, which was heard recently, closing at 3 pm. Radio Excelsior also operates on 6075 Kc, and the manager, Snr. G. R. Gillo, offers to broadcast a special program for listeners in this area, at a more suitable time for reception.

2AP-APIA, Samoa, which tested in early August on 6040 Kc, and has now been verified by Jack Corbett, Brisbane. They confirm reception with a new black and white card, with large call letters in red. Readers should watch the 6040 Kc frequency as it is expected that 2AP will be testing periodically.

DETAILS of stations being heard by readers should be sent to 212 Earn Street, Invercargill New Zealand. All times are Australian Eastern Standard.

4VWA, Radio Citadelle, Cap Haitian, Haiti, which operates on 6300 Kc, and has been heard at 10 pm when they sign on. Verification has now been received by Jack Corbett, in the form of a letter from George Bonoy, the announcer. A postcard, showing the fortress of Henri Christophe, was also enclosed, and from this the station takes the slogan "Radio Citadelle".

COMMERCIAL SERVICE of Radio Ceylon is at present broadcasting programs in English directed to India daily from 11.30 am-2.30 pm on 15,120, 7190 Kc, 10.30 pm-3.30 am on 11,974, 6006 Kc. To India in Hindu on 9520 Kc, 11.30 am-2 pm. To South East Asia in English on 17,820 Kc, 8.15-10.15 pm. Geoff Oates, Stawell, Victoria, reports signals good on 11,975 Kc at 10.30 pm and fair on 6006 Kc.

UNITED NATIONS, broadcast from Geneva, formerly carried on 6675 Kc, is now broadcast on HED5 (9545) on Tuesday to Saturday. Transmissions are from 4.15-5 am, with English news at 4.30 am.

AMERICAN RELAYS in Greece at Salonika, and on the Courier now based at Salonika, include several new frequencies put into operation. The complete S/W schedule for the Courier is now 6015 Kc (4-11.45 am), 7200 (2.30-11.45 am), 9685 (12.15-3.30 am), 11,805 (12.15-2.0 am). The Salonika transmitter is operating on 5960 Kc (4-8 am), 6040 (3.45-8 am), 7270 (3.45-8 am), 11,735 (12.15-3.30 am), 11,845 (12.15-2 am), 11,880 (2.30-3.30 am), 15,315 (12.15-3.30 am).

DELHI'S External Service has been extended to cover Hindu listeners in West Indies, Fiji, and the Indian Forces in Korea. The complete schedule shows the use of several new frequencies, including 3935 (3.30-5 am, Arabic), 3950 (5.45-6.30 am, French), 6145 (10.45-11.30 pm, Urdu), 9715 (10.45-10.55 am, Burmese), 9750 (10.30-11 am, SE Asia), 11,810 (9-11.15 pm, SE Asia), 11,820 (2.30-3.30 pm Arabic), 15,240 (5-6 pm, Fiji).

VOA-MUNICH, the powerful short-wave relay station, is now using a frequency of 3980 Kc for transmissions of the Voice of America from 2.15 am to 8 am. Munich's use of this frequency follows our recent mention of the use of this 75M band by London and Paris.

The Voice of America floating transmitter ship, Courier, now stationed at Salonika, Greece, and using new land-based antenna systems, has been logged using 6015 Kc from 4 to 11.45 am Salonika now operates on 5965 Kc from 4-8 am and on 6040 Kc, 3.45-8 am.

RADIO NETHERLANDS transmissio to the Australia-New Zealand area which during our winter is broadcast i the afternoons, reverted to the evenin schedule on November 1. From that dat transmissions have been heard daily o 15,425, 15,220 and 11,730 Kcs, the forme being a new frequency for Hilversum The transmission time is 7.45-8.20 pm for the English service. Eddy Startz with his popular "Happy Station" program, which completed its 25th year o operation recently, is carried on these frequencies each Sunday from 8.30 pm, an includes a very bright and happy program, compered by Startz, an announce with seven languages at his disposal.

BRAZIL'S PRL5, located in Rio d Janiero, and operated by the Ministr operation recently, is carried on these frequency, 11,920 Kc, and can be hear from opening at 6.50 pm, though som interference is had from HCJB (Quito which is now on a 24-hour-a-day schedul PRL5 was formerly on 11,950 Kc, and i our summer, usually provides a fai signal in the evenings. The fact tha Brazil is now on summer time means a hour earlier in the opening times of man of the stations, and we can hear sever at 7 pm, the other good signals are fro PRL7 (9720) and ZYC8 (9610).

HOLLANDIA'S 60M frequency is no 5045 Kcs, and they have been heard 8 pm with a transmission in English f listeners in Australia, the English is n very good, but readers will find t broadcast interesting when we reali the difficulty under which the stati operates, and when the new Biak tran mitter is opened, a good service will assured.

SOUTH KOREA'S Voice of Free Kore operating on HLKB, Pusan, on 7935 K has added an English session at 7.30 p which included news and western recor ings. The Seoul transmitter HLKA 2510 Kc is now using 10,000 W, while t second Seoul outlet, on 3895 Kc, togeth with HLKB, operate with 1000 W.

BIRTHDAY FOR FEN IN JAPAN

FEN—Tokio, the Armed Forces Radio Service stations operating in Japan have just completed 8 years of operation.

ON September 21, 1945, just 16 days after the first American troops entered Tokio, the United States Army began broadcasts from Japan from two mobile units. Two days later, using Japanese transmitters, the short-wave service was established. The writer heard the broadcasts in late September on 7552 and 9605 Kc, when the transmitters were using 25 Kw.

The Far East Network has extended to cover all of Japan, and then in 1950 established the American Forces Korean Network, to provide programs for United Nations personnel in Korea.

The FEN transmitters are located outside Tokio, and consist of one 20 Kw station at Nazaki and one 10 Kw at Yamata. They relay the programs of FEN-Tokio on B/C.

The FEN employs some 104 US Army personnel together with many civilian personnel to maintain the service; and the total broadcast and short-wave transmitter power is 185 Kw. Reports on reception of the FEN short-wave broadcasts are received from all parts of the world and average about 50 each week

Regular broadcasts in Dutch, French, Greek, Belgian and Turkish are broadcast over the JLK and JKI short-wave stations for reception in Korea, while special programs for British Commonwealth Forces are aired regularly.

The present schedule of the Tokio stations is: JKL (9605), 7 am-7.45 pm,, (4860), 8 pm-1 am; JKI (11,825), 7 am-7.45 pm, (6080), 8 pm-1 am.

YSAX IS STRONG

YSAX, in Salvador, El Salvador, though not a new transmitter (it has been in operation for a year) is providing good signals in the afternoons. YSAX uses the slogan "La Voz Panamericana" and closes at 4.05 pm with the Warsaw Concerto, followed by a four-note chime. We have heard some American transcription programs at 3.15 pm, including plays, with dance music from 3.45 pm to sign off. A four-note chime is given frequently, and the station uses 5000W. The address is YSAX, "La Voz Panamericana", 23 Avenida Norte, Number 25, San Salvador, El Salvador. YSAX relays the medium wave station, which has the same call sign on 800Kc. YSAX operates on 11,950Kc, and is heard with signals about the same strength as the Cairo station, which operates at the same time on 11,965Kc.

VERI FROM ECUADOR

EMISORA "GRAN COLOMBIA" in Quito Ecuador, which we reported hearing in May, verified by letter from the owner, Snr. Eduardo Cevallos, of HC1MI at Casilla 2246, Quito. HC1MI was heard on 4846Kc but is listed by the station as on 4890Kc, but we think that the frequency shown on the letter is an old one. The B/C relay is HC1MJ on 1410 Kc. HC1MI operates with 250W and the schedule is not listed, but we have heard them to after 2 pm on Sundays. Booklets and photos of Ecuador are being sent to us by surface mail.

LISTEN FOR THESE DX STATIONS

Kcs	Call and Location	Times Heard (AEST)
3980	Munich-11, Germany	VOA 2.15-8.00am.
5045	Hollandia, New Guinea	English to Aust. 8-8.30pm.
5960	Salonika-2, Greece	VOA relay 4.00-8 00am.
7220	Belgrade, Yugoslavia	Home service 6.30am.
7280	HVJ7, Vatican City	Hungarian broadcast 6.30am.
7935	HLKB, Pusan, Korea	English news 7.30pm.
9570	Bucharest, Rumania	English news 5.30am.
11900	WGEO-3 New York.	AFRS broadcast 4 00-8.00am.
15425	Hilversum, Holland	English 7.45-8.20pm.
15440	Tangier-8, North Africa	VOA relay 9.45pm-5 00am.

THE HAM BANDS WITH BILL MOORE

A new method of reporting telephony signals has been suggested at a recent amateur radio conference. The system will allow a more concise report to be exchanged, and operators in order to comply with the code will have to closely examine incoming phone signals.

CONSIDERABLE publicity is being given in Europe to a system of signal re- orting for telephony, The RSM Code, nalogous to The RST Code for tele- raphy.

The plan originated at the Lausanne onference, when it was considered that more accurate method of reporting tele- hony was required than the current RS ode.

The introduction of the third index was hoped, would readily point out to perators faults in their transmissions nd force reporting stations to examine lephony signals closely.

The RS indexes of the RSM code ould remain as at present, while the M ating should comprise five steps as be- w.

M1—unintelligible modulation (pre- umably you might have to initiate the ntact on CW).

M2—Defective modulation due to spur- us or parasitic oscillations, or to causes nknown.

M3—Defective modulation due to fre- uency modulation of the carrier.

M4—Defective modulation due to over- odulation.

M5—Good modulation, not exceeding 00 pc.

It would appear that eventually the ode will be circulated via the IARU cal- ndar to National Societies for comment.

The WIA will deal with the matter ere in Australia.

It was decided, too, to encourage the rmation of a telephony equivalent of e existing A1 Operators' Club for tele- raphy.

OVERSEAS VHF

The Irish 144 mc transatlantic tests ere conducted for nine days in July, nd were sponsored by the International HF Society. No contacts were made ut the tests provided some interesting ception reports.

The society set up two stations — e for CW, one for telephony—in estern Eire operating on 144.18 nd 144.196 mcs. They were manned E1 and G1 amateurs.

On the other side of the Atlantic, the st was organised on behalf of the RRL by Ed Tilton, WIDHQ, VHF editor QST.

Weak and unidentified CW signals ere heard on two occasions early in the st. On the second last day G15HV eard a CW signal signing de W4 on 5.3 mcs. The same signal had been eard earlier by E12W and 3W.

The station was in the correct direc- on for the US, and broke and resumed ansmission at the times prescribed for stations.

G8AO/mobile marine operates on the 4 mc band and judges propagation con- tions on the band by a novel method is able by experience, to prophesy the appearance and definition of the astline on his radar screen, if DX enings are likely to occur.

While cruising along the British coast d in contact with G stations, he has ite ofen given them news of possible X.

The NSW VHF section's 144 mc D/F ld day was run on the first Sunday October, and was well supported de- ite inclement weather conditions.

Five parties using the calls VK2NP K20A, VK2WJ, VK2ABH, VK2ADY, were the field. These stations transmitted m fixed locations, and their positions d to be pin-pointed by DF bearings ations in the field and home stations the Sydney area participated.

t is believed some interesting fixes re obtained, even out to sea, and the uits will be announced after the com- analyse the plotted positions sub- tted.

WOY WOY FIELD DAY

Final arrangements for the NSW Division's Woy Woy Field Day include entertainment that should suit allcomers. The day is conducted annually by the division with the co-operation of the Hunter branch and local amaters. It is the one occasion during the year when, at a central point, amateurs from the Hunter branch and the country meet the Sydney gang.

Attendances on the last occasions have exceeded the 200 mark and, judging from early inquiries, this year's event should be well supported.

Assembly will be between 10.30 and 11 am, the venue the Masonic Hall, Woy Woy. No prior booking is required, just come along, bring your family and friends.

If you can indicate your intention of attending, it would assist the organisers. Please contact the secretary, Dud Millen, VK2LQ, or Cess Hardman, VK2KR, of Woy Woy.

The morning session will commence at 11 am with competitions. For amateurs attending with mobile or portable equipment, the "all band scramble" will be run from 11.45 am to 12.30 pm. Lunch period from 1 to 2 pm.

At 2 pm searchers will leave to locate the hidden transmitter on 144 mcs. Transmissions will cease at 3.15 pm. During the afternoon special competitions will be conducted for the ladies and sporting events for the kiddies.

From 4 pm to 5 pm presentation of prizes and general reunion.

Don't forget the date, November 15, make Woy Woy the terminal for your Sunday excursion . Demontstrate to the wife there are other aspects of amtaeur radio besides heaps of equipment, and long sessions in the shack.

INTERFERENCE ON 2WI

On odd occasions through the past few years, the Sunday morning broadcasts by VK2WI have been deliberately jammed by an unmodulated carrier swinging a few thousand cycles each side of zero beat.

The broadcast of September 27 was badly affected in most portions of the State by this interference. It is difficult to understand the mentality of the operator. If it happens to be a "pirate" trying to check the effectiveness of his transmitter, it should be recorded he obtained good coverage on that Sunday and when he was not tuning it, his VFO was very stable.

Any information that could possibly lead to the locating of the offending station, would be appreciated by the NSW WIA council. If the interference continues a concerted D/F check will be made.

Perhaps the only happy feature of this latest incident was to demonstrate the considerable interest taken in WIA broadcasts. Normally, operators of WIA official stations receive reports weekly, mainly from a few regulars. On this occasion dozens of stations called up to express their disgust at such deliberate jamming. Many other stations on the 40-metre band were also heard voicing their disapproval. It is hoped the offender has received sufficient adverse publicity to cease future activity.

AOCP CLASSES

The NSW Division's new AOCP class commences in early November and intending amateurs can obtain information from the class manager, Box 1734, GPO, Sydney.

The course covers complete instruction on theory, regulations, and Morse sufficient to qualify for the amateur operator's certificate of proficiency and so operate an amateur radio station.

Recorded tapes are playing an important part in passing technical information to country members of the NSW Division.

The latest was recorded by Dr. Bob Black, VK2QZ, the subject. "UHF Equipment". Suitable photographs and diagrams accompany the recording and these were prepared by Ken Kimberley, VK2AXZ. Country amateurs speak highly of this service.

Recently elected to the NSW Divisional Council is Don Pollard, VK2ASW. Don should provide a younger outlook on the many problems and is a very active amateur in many fields. He has been an ardent supporter of the WIA for a number of years.

Late September saw the completion of

WESTERN ZONE HOLDS CONVENTION

The first zone convention of the Western Zone, NSW, WIA, opened at Forbes, 296 miles west of Sydney, at 3pm on Saturday, October 3. A representative gathering of amateurs from various parts of the State attended, including VK2JR, 2TA, 2JU, 2ABU, 2ACU, 2XZ, 2EI, 2XP, 2JV, 2APP, 2SJ, 2AMV, 2ASE, 2AWQ, 2YC, 2VC, 2IQ, 2IC, 2AXS, 2BT, 2BW, Messrs Norm Moody and Frank Pearson.

Joe Reed, VK2JR, well-known lecturer on amateur problems, presented the initial item, a technical talk on Oscillators The talk had been previously recorded on tape allowing the lecturer full scope to display the slides he had specially prepared to illustrate the lecture. The afternoon session was devoted to technical problems.

After dinner, a 16mm film, Solar Prominences, lent by the CSIRO, was displayed, followed by a further lecture by Joe Reed, VK2JR. His subject, The Ionosphere, was again fully illustrated by slides.

On the arrival of the State president Jim Corbin, VK2YC, from Sydney, the business session was opened. A full discussion on zone organisation and boundaries was held General country problems of the WIA were also discussed

At the conclusion of the evening session all in attendance were entertained at the home of John and Mary Meagher, VK2AMV. Mrs. Meagher dispensing country hospitality to the full, and amateurs greatly appreciated her work for their enjoyment.

The VK2WI Sunday morning broadcast was presented at 11 am on 7 mcs over VK2AMV, and relayed on 3.5 and 144 mcs by VK2WH. A technical talk at short notice was given on the B/C on some Antenna Problems by Angus Robertson, VK21Q.

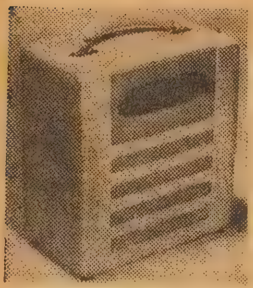
The visitors were then entertained at a barbecue at Cumbijowa, the home of Hugh Stitt, VK2WH. After inspecting the equipment, amateurs were introduced to the 144 mc DF hunts. The transmitter was moved about while the various parties went out in turn to locate its position.

On the Sunday evening, a display of flood films was given by VK2AMV. It will be remembered that Forbes' amateurs were active handling emergency traffic during these emergencies.

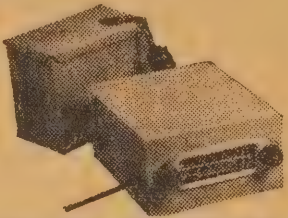
The convention details were arranged by zone officer, Hugh Stitt, VK2WH, and John Meagher, VK2AMV; and it is hoped that the event will be conducted annually.

What Better Gift . . .

. . . for Outdoor Enjoyment!



The E. P. range includes a portable to suit every possible purpose, and such units as "Carry Set", "Springtime Portable," "Jubilee Portable," "Senior Portable," and "Rambler," etc., are available. Also included in this range are two car radios and a unit specially designed for caravans.



Illustrated: Top—Jubilee Portable. Bottom—Karset.

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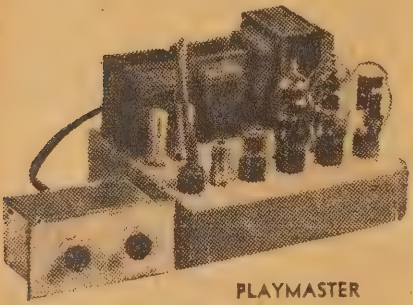

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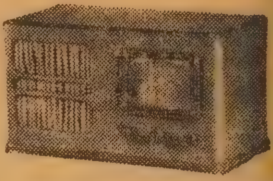

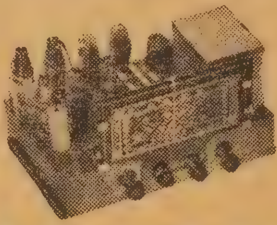

Illustrated:. Fireside 5. and Vibragram 7.

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THE KIT-SET SPECIALISTS

a series of visits by members of the NSW Council to country districts. The South Coast zone with headquarters was visited on this occasion. Councillors Jim Corbin, VK2YC; Bill Lewis, VK2YB; Roy Pearce, VK2IV; Stan Bourke, VK2EL; Don Pollard, VK2ASW, and Hec Harvey, VK2ACI, attended the meeting which was held at the clubrooms of the Wollongong Amateur Radio Club. Zone officer, Eric Fisher, VK2DY, was responsible for the local organisation.

The Federal executive of the WIA announced in Amateur Radio that it had been informed of the terms of the issue of the limited licence for amateur operators, which was in the original proposals termed a "Technical Class" licence.

This new class will be known as "Limited AOCP" and holders will be permitted to operate on the 144 mc band and above.

The examination will comprise all sections of the AOCP, excluding sending and receiving morse. These latter tests can be sat for at any future date. Thus the holder would be then qualified for operation on any of the amateur bands.

The arrangements appear to be very satisfactory and on better terms than similar limited licences overseas. The fact that the applicant is not required to sit for further examinations in theory and regulations when obtaining the normal AOCP is an excellent feature.

HUNTER HUNTS

The nocturnal 144 mc DF hunt run by the Hunter branch in the environs of the coal city on the evening of October 3 resulted in a win for Geoff Partridge, VK2VU, of Singleton.

Geoff was the only competitor to locate the transmitter, the others finishing in scattered positions around Newcastle.

The hunt, together with photographs, was front-page news in the Newcastle daily Press and the reporter stated he had the greatest difficulty locating the transmtiter, despite detailed instructions on its location.

The following day a successful outing was held at Blackalls, the NSW Divisional Council being represented by Don Pollard, VK2ASW. The State president's wife, Ruth Corbin, and family also journeyed up from Sydney.

The CW section of the VK/ZL DX contest, run on the weekend, October 10 and 11, saw limited activity, and propagations were possibly the poorest experienced since the inception of the contest in the mid-'30's.

The 14 mc band on the opening afternoon provided little DX, only a few Pacific stations appearing at this QTH The ZL's seemed to do better, as both European and African stations were possible contacts over there.

7MC was fair to the US despite heavy QRN. 21MC seemed to provide the best DX and was open to the US and Asia. According to VK2WH, KG6AUA stated that the best opening stateside ever experienced occurred during the weekend. W stations were at excellent strength on 3.5 mc CW but were engaged in their CD contest and contacts were difficult to make.

Participants in the contest earned every point gained and full support for DX contests will not be evident until conditions improve.

DX AND PERSONAL

7MC showed considerable improvement in late September and should be the most interesting band in the VK/ZL DX contest. Europeans have been breaking through at good strength from 0600 to 0700 hours EAST, although they are often hard to contact, due to the heavy QRM in Europe. They are again workable the long way around from 1600 to 1800 hours. Best DX heard was PXIA, 0630 hours, 7015 Kcs; he could be legitimate although many PX's operating in the past were not in Andorra. Static, however, is on the increase and some evenings were completely written off.

New station heard on 3.5 mcs was KX6BE, 2100 hours, 3507 Kcs; W2PEO is still the most consistent W station on the band.

The general view among amateur radio societies in Europe is to the effect that no international telecommunications conference affecting amateur radio would take place before 1957, and possibly at a much later date.

Some of the Atlantic City conference (held in 1947) regulations have not been fully implemented. These societies decided at the IARU conference held recently at Lausanne to establish a fund which would allow one or two representatives to attend the next international conference on behalf of Europe's radio amateurs. Contributions by the societies will be pro rata on a membership basis

Amateurs who missed the obituary notice in QST will regret to learn of the passing of Reg Fox, AC4YN, the doyen of DX. Reg operated the world's most elusive DX station, 12,000ft up in Lhasa, Tibet. He was for many years, prior to the Red occupation in 1951, personal radio operator to the ruler of Tibet, the Dalai Lama. AC4YN was also in charge of the country's communication service. In recent years he was resident in Northern India.

There are at present 25,760 amateur radio stations licensed in Europe—of these 28 pc or 7500 are located in Great Britain, 3100 in Italy, 1800 in Sweden.

On 7MC in the evenings a good signal arrives from Fred, W5AQE, of Odessa, Texas Using an antenna under the rafters, the transmission ofen peaks at S7.

LATEST METHODS OF SET ASSEMBLY

(Continued from Page 53)

ture after it has been mixed with a "hardener".

Another one which is easy to use in the small shop is a polyaster type resin which "cures" in a similar nanner. While this material is used xtensively by hobbyists for the nounting of flowers, insects, coins, nedals, &c., it also has good elecrical characteristics and can thus e used successfully for electronic otting.

Figure 4 illustrates typical steps in ssembling a miniature electronic ircuit and imbedding it in a block f polyester resin. A parallel-T elective R-C network has been elected for illustration.

Figure 4 (A) shows the circuit and (B) the components assembled by he direct connections together of heir pigtail leads. The assembly hen is hung in a mold made of a small paper box. The inside of this box must be lightly coated with furniture wax or soap. The hanging is shown in Figure 4 (C).

The casting material is prepared in the following manner: Work outdoors or in a well-ventilated room. Measure out the amount of resin liquid required with a tablespoon. Add one drop of the supplied hardener for each tablespoon of resin. Stir the mixture thoroughly allow to stand for 5 to 10 minutes and break any bubbles with a straw or long toothpick.

Pour the mixture into the mold slowly, avoiding bubble formation. The mixture will thicken and jell. There will be heating due to chemical action. Allow to cool slowly to room temperature.

After eight hours the mould may be removed (see Figure 4D) if the mass has hardened sufficiently. An alternative procedure for fast hardening and curing is after the mass has cooled to room temperature, to heat it for 30 minutes in an oven at 160 to 225 degrees F.

The potted block is transparent and colorless and will reveal the imbedded components and wiring.

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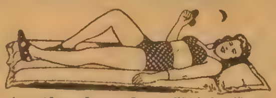

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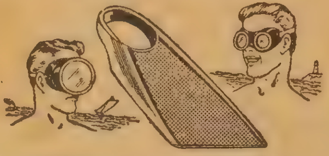

GOGGLES, 15/6; MASKS, 16/11
Fins, Large size, 8-10, 32/6; Med. size, 6 to 8, 32/6; Small size, 3-5 and 1 to 3, 24/6; Junior size, 18/6.

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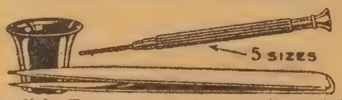

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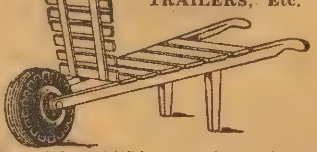

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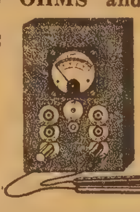

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250 Volts,
500 Volts,
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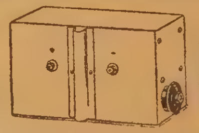

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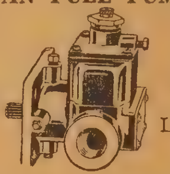

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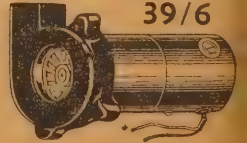

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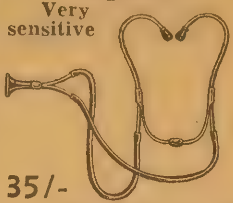

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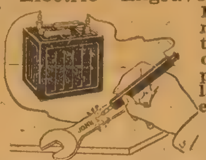

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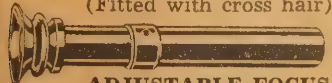

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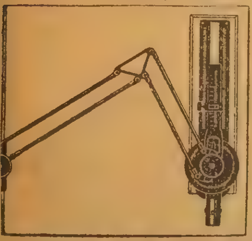

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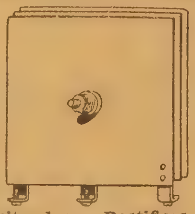
6v.	2 amp,	24/6
6v.	4 amp,	45/-



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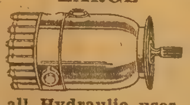

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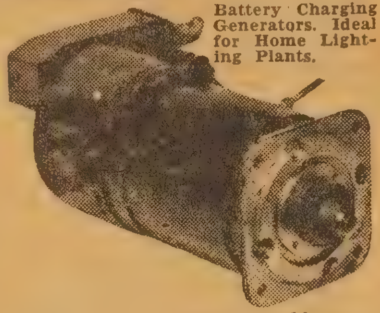

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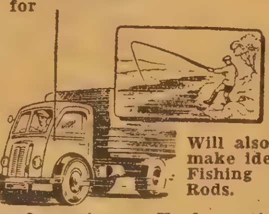

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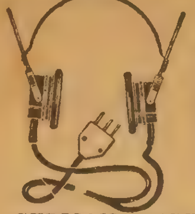

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OUR PRICE 39/6

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OUR PRICE 18/6
Weight 1¼lb.

NOTICE

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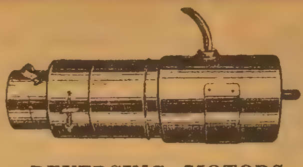

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A light weight 24 volt motor suitable for Rotary Beam Aerial Control, etc., the gear ratio is extremely high and a brake automatically holds the motor in any desired position. Just the thing for the radio amateur.

PRICE £3/19/6 Weight 10lb.

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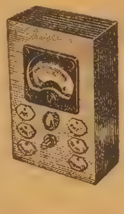

For the radio repair man, amateur experimenter, motor mechanic and electrician. This pocket size multimeter is ideal. DC Voltage readings 0-15, 0-150, 0-300, 0-600.

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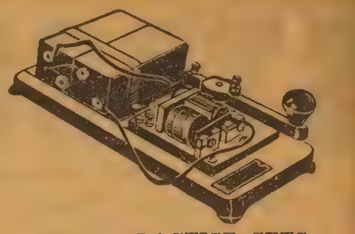

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18. Switch Panels. Airscrew type. Panel has 2-3 position selector switches, 2-70 amp overload circuit breaker switches, 2-2 way 70-amp toggle switches. Price only 17/6 ea.
19. Switch Panels. Two triple toggle switches, three single toggle switches and four push buttons, all mounted on aluminium panel 12¾ x 5 inches. Switches are suitable for voltages up to 32 at 20 amps. Price 10/6 ea.
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JOB CONDENSERS: The following condensers are available, many are ex-British Navy and all can be thoroughly recommended.

Cap. Mfd.	Type	Voltage DC	Price	
.0001	Silver Mica		6d ea.	4/6 doz.
.001	Tubular Paper	1000 wkg.	6d ea.	4/6 doz.
.005	Tubular Paper	1000 wkg.	8d ea.	6/- doz.
3 P F	Mica		3d ea.	2/6 doz.
5 P F	Mica		3d ea.	2/6 doz.
.01	Bakelite Tubular	1000 wkg.	1/6 ea.	15/- doz.
.0002	Mica	1500 wkg.	8d ea.	6/- doz.
.0004	Mica	1500 wkg.	8d ea.	6/- doz.
.1+.1+.01	Star Paper Tubular	2250 test	1/- ea.	
2 mfd	Electrolytic	500 wkg.	1/- ea.	
50	Electrolytic	12 wkg.	6d ea.	
25	Electrolytic	50 wkg.	6d ea.	
75	Electrolytic	12 wkg.	8d ea.	
.1+.1	Block	1500 test	1/3 ea.	
.25	Block	1500 test	1/- ea.	
.01	Metal Tubular	375 wkg.	9d ea.	7/6 doz.
.0023	Mica	500 wkg.	1/- ea.	
.5	Block	1000 test	1/- ea.	
1	Block	500 wkg.	1/3 ea.	
.5+.5	Block	500 wkg.	1/6 ea.	
1	Block	800 test	1/3 ea.	
8 x 8 x 8	Electrolytic	450 PV	3/3 ea.	36/- doz.
50	Electrolytic	50 wkg.	9d ea.	
500	Electrolytic	15 wkg.	1/- ea.	
30	Block	100 wkg.	2/3 ea.	
1	Tubular Metal	375 wkg.	1/6 ea.	
250	Block Electro.	25 wkg.	9d ea.	
50	Tubular Electro.	25 wkg.	6d ea.	
4	Tubular Electro.	450 wkg.	1/6 ea.	
.5	Oil Filled block	8000 test	4/6 ea.	48/- doz.
.1	Block	4000 wkg.	4/6 ea.	48/- doz.
1	Block	500 test	1/6 ea.	
.25+1.8+1+1	Block	500 wkg.	3/9 ea.	
.5	Block	1500 wkg.	3/- ea.	
.02	Block Mica	300 wkg.	1/- ea.	
.1	Tubular	350 wkg.	9d ea.	
.1	Block	800 test	9d ea.	
.1	Block	500 test	9d ea.	
.03	Metal Tubular	5000 wkg.	3/6 ea.	
.055	Block	2500 test	1/6 ea.	
.5	Block	2000 test	1/9 ea.	
.5	Block	500 wkg.	1/- ea.	
.25	Block	2000 test	1/6 ea.	
.25	Block	2500 test	1/9 ea.	
.25	Block	2500 wkg.	4/6 ea.	
.25	Block	2000 wkg.	4/- ea.	
1	Block	1500 wkg.	5/9 ea.	60/- doz.
16	Tubular Wet Electrolytic	350 PV	3/- ea.	
.01	Oil filled	5000 wkg.	6/6 ea.	
.02	Oil filled	10,000 wkg.	8/6 ea.	
.01	Block	5000 wkg.	6/6 ea.	

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AN ELECTRIC SOLDERING IRON

Nearly all hobbyists need a soldering iron so why not make one yourself? This is a low voltage design and is therefore safe to use anywhere. It should be adequate for all small jobs including wiring.

By W. L. WILLIAMSON

THIS electric soldering iron has been designed with a view to efficiency and, at the same time, safety. Quite a number of those on he market today have been designed to operate on a 250-volt 50-cycle supply and this voltage can be dangerous when a soldering iron is used without an earth connection, and he user is standing on a damp or concrete floor.

With this in mind, an iron to operate at 18 volts or a little less has been devised by the writer. The chief factor in this job is a suitable transformer to work off, say, 230-250 volts 50-cycle supply for the primary side, and giving 18 volts 3-4 amps from the secondary winding. There should be an earthed screen between the primary and secondary windings, otherwise the safety facor in using a low-voltage iron is ost.

After a number of tests on the ron it was connected to a low-voltge metal rectifier (full wave) beween the 18-volt AC side and the lectric iron, and the result achieved howed a slight improvement in its peration.

It took a little longer to heat up, ut maintained a nice working heat n direct current, and the current onsumption was 2.2 amps, against .0 amps on AC.

CONSTRUCTIONAL DETAILS

The component parts are few and re easily obtained. They are as ollow: One piece 5-8in round coper rod; one piece mild steel, 1¾in ong, 5-8in wide, and 1-8in thick; ome good-quality mica; about 2ft f strip resistance wire, .025in wide nd .007in thickness, rated at 12 hms per yard; two 4 BA cheese-eaded tap screws; one 4 BA nut; ne 5 BA cheese-headed tap screw; nd a few 4 and 5 BA brass washrs.

As a sheath for the copper bit se a length of asbestos tubing, 5-8in ore and ¾in outside diameter.

After obtaining all the parts first ut the copper rod to size and shape as shown in Fig. 1. Drill and ountersink the two 4 BA clearance oles, making sure that the heads re flush with the radius of the opper.

Next, make up the mild steel amping plate, drilling and tapping he two 4 BA holes, and radius the top sides of the plate, otherwise it will not allow the asbestos tube to fit over the assembly when completed.

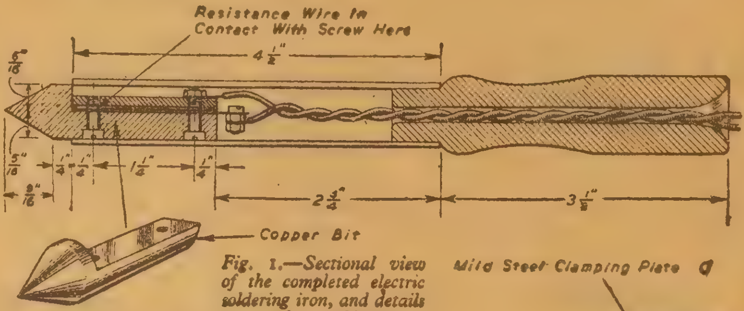

Fig. 1.—Sectional view of the completed electric soldering iron, and details of assembly.

The mica strips should now be cut out and the holes punched out as shown in Figs. 2, 3 and 4; the strips should be .02in. in thickness. The heater unit should now be made up for this; cut off 18½ inches of the strip resistance wire, pierce a small hole at the left-hand end of the mica strip (Fig. 2) near the 4 BA hole, and bring the wire end from the underside through the hole and leave sufficient wire to be able to take one or two turns round the 4 BA tap screw after assembly.

Wind on 12 turns, taking care to keep the wire flat and tight, also see that the turns do not touch. Thread the finishing end through the right-hand hole and enough to connect to the terminal on mica strip (Fig. 3).

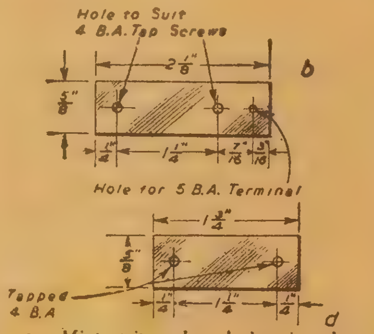

Fig. 3.—Mica strip and steel clamping plate.

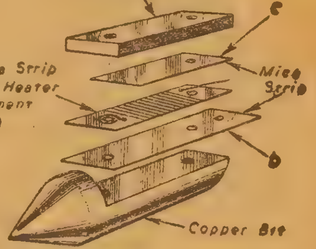

Fig. 5.

See that the wire does not touch the 4 BA screw when assembling.

ASSEMBLY

Lay the mica strip b on the copper bit (Fig. 5), and on top fit heater unit and the next mica strip c (Fig. 4). Lay the wire end carefully in position around the lower 4 BA tap screw and place a 4 BA washer over it; this should be slightly higher than the mica strip (Fig. 4) so that when the mild steel clamping plate d is fitted, it presses firmly on the wire end and washer.

After laying this plate in position, fix it by means of the two 4 BA screws, the longer one at the right-hand end (see Fig. 1), as this has a nut and washer fitted for one of the connection points, the other being the terminal nut on the mica strip (Fig. 3).

On completion, try the assembly in the asbestos tube; it should be a nice push fit. If it is too easy, a thin piece of mica could be used to keep it in position finally. Remove the copper bit and connect a 5ft length of twin flex (5 amp. rating) to it, then thread the flex through the tube and replace the "bit" and make secure.

All that remains is to fit the handle, after boring, to take the flex and securing by means of two wood screws. The electric iron is now ready for trying out. Connect flex to the low-voltage supply, either AC or DC, whichever has been decided upon, when it will be found that the iron attains a nice working heat in about seven minutes, or slightly less on AC. The current consumed on the mains side by the writer's transformer is approximately .116 of a unit per hour with the iron in operation.

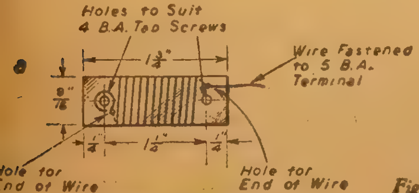

Fig. 2.—Mica strip and heater element.

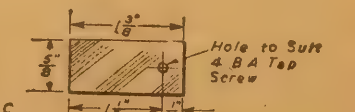

Fig. 4.—Mica strip for placing under the clamping plate.

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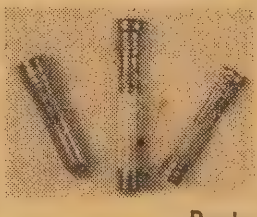

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N.B.: These condensers are conservatively rated and can be used successfully at Higher Rating.

6 VOLT PUMPS

40 P.S.I.

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12v	250v 100 mA	£3/10/-
24v	250v 100 mA	£1/10/-
24v	300v 250 mA	£2/10/-
24v	575 mA	£3/10/-
24v	550v 215 mA	£3/10/-
6v	220v 60 mA	£3/10/-

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5Y3	10/6
6SH7	3/6
7193	3/6
VR65A and Socket	3/6
1K 5	3/6
EA50 and Socket	3/6
6SK7	12/6
6SQ7	12/6
EZ82 (6v4)	10/-
VR150/30	15/-
1625	20/-
12J5	7/6
6V6	13/6

HOW TO MAKE A LIE DETECTOR

You can have great fun with this little device and incidentally learn something about the mental and physical characteristics of the human frame.

By FRANK DIXON, MA

PSYCHOLOGISTS tell us that the emotional stress which we experience when practising a deliberate deception is accompanied by certain physical changes that can be measured. Changes in breathing, blood pressure and the electrical resistance of the skin.

The device I am about to describe—the psychogalvanometer, to call it by its scientific name—records the last of these. When we are in a situation fraught with danger or uncertainty, we perspire more profusely than at normal times.

This increase in sweat secretion, though it might not be sufficient to produce drops on the forehead, does produce a "drop" in the electrical resistance of the skin.

This lowering of resistance can be measured by attaching to the palm and back of a person's hand two electrodes, which are connected to the circuit shown in Fig. 1.

Look at this circuit carefully. You will see that it is arrangement of the Wheatstone Bridge. When the electrodes are attached, if the variable resistances are adjusted so that the potential is equal at the opposite corners of the square which are connected through the galvanometer, that instrument will register no flow of current.

But if the subject's skin resistance suddenly decreases the balance will be upset and current will flow through the galvanometer, causing it to give a "kick".

From the medical data given above it should be obvious that such deflections may be expected whenever the person tells a lie.

CONSTRUCTIONAL DETAILS

This handy form of lie detector can be built quite cheaply, the most expensive piece of apparatus being the galvanometer itself. The kind you use depends upon your personal attitude to the experiment. If you are genuinely interested and have the money to spare, your choice will undoubtedly be the "mirror" galvanometer with a light spot scale. If, on the other hand, you are seeking a new stunt for your next birthday party, a humbler instrument of the moving needle type will probably suffice.

A word about the electrons. When making these, great care must be aken to avoid possible polarisation effects. Two brass or copper discs bout the size of halfpennies are ecommended. Clean and polish hem and cover them with chamois eather soaked in saline solution. Make sure, though, that there is a ood dry connection between the lectrode and the copper wire of the ircuit.

As for the resistances, preferably hey should be post office types, or Wheatstone Bridge nichrome wire; ut here your choice will be dicated by circumstances. Since the war, for instance, it has been possible o pick up useful parts, often at bargain prices, at those shops which specialise in the sale of surplus Service equipment.

Don't forget that materials already in your possession can often be incorporated. In the present case, if you have resistances lying around which you think might be suitable, by all means give them a trial.

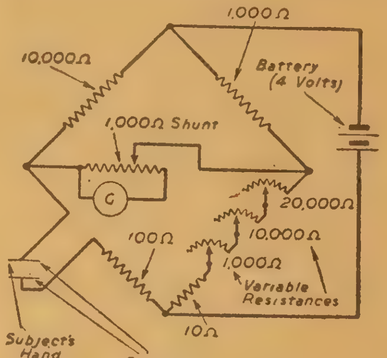

Fig. 1.—Circuit diagram.

For the benefit of those who are unable for some reason to use the circuit given in Fig. 1, a practical alternative circuit is given in Fig. 2. This is much simpler, as it omits the galvanometer shunt and includes only one variable resistance.

USING THE APPARATUS

Here are some directions for using the lie detector. They must be followed most carefully if your experiments are to be successful.

1. Wash the subject's left hand, removing all grease and dirt in order to make the skin highly conductive.

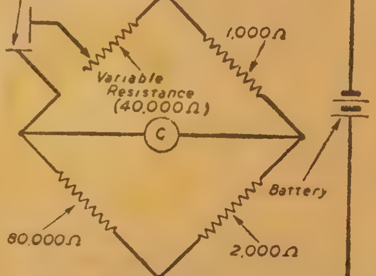

Fig. 2.—Alternative circuit diagram.

2. Encourage the subject to relax in a comfortable chair, to the arm of which his or her left arm is strapped. (This is necessary in order to prevent false readings as a result of muscular movements.)

3. Attach the electrodes to the subject's left hand. These may be held in place by an elastic band.

4. Wait for five minutes to allow the subject's bodily resistance to reach normal.

5. Adjust the variable resistance(s) until the galvanometer gives an average reading of zero.

6. If the circuit shown in Fig. 1 is used, adjust the galvanometer shunt until the needle or light spot stays reasonably steady while the subject is at rest.

7. Start to put your questions, all of which should lead to a straight "Yes" or "No" in answer. Before going on to the more pointed queries, ask trivial ones which the subject can deal with easily and truthfully. Ask them at intervals of 30 seconds, adjusting your main resistance(s) at five-minute intervals to allow for a gradual change in the subject's resistance while the interrogation is proceeding.

VARIOUS TESTS

Several tests may be carried out with the lie detector. The questioner may say, for example, "I want you to try not to tell me the month in which you were born. As I read out the months please answer "No" to each one, whether it is right or wrong. Was it January . . . February . . . March?" As he reads through all 12 the galvanometer will usually give a deflection when the correct month is mentioned and denied.

A similar experiment can be conducted with playing cards. The subject takes a card, which he memorises and puts back in the pack without showing it to anybody. He is then shown each card in turn, and more often than not will betray involuntarily the card chosen. (This experiment is more effective, and takes less time, if a small selection of cards is used instead of the whole pack.)

The party game, False Witness, popularised on the radio by Lionel Gamlin, is much more interesting when played with a lie detector. Two people are sent out of the room. One is isolated, hears nothing; the other is told a crime story, perhaps about a spiv filtering red petrol to remove the dye. They return and are both asked questions containing the words "spiv", "red", "dye" and "petrol". The readings of the machine which can be compared with the independent findings of a "judge" or "jury" show who is the false witness.

The psychogalvanometer has other more serious uses, but there is not space to give a detailed account of them in the present article. Psychologists enlist the help of the instrument when analysing dreams, investigating complexes, treating amnesia, and diagnosing different types of insanity.

You can have lots of fun but if you build one, remember this final word of warning: Don't take the readings too seriously!

ANSWERS TO CORRESPONDENTS

P.G.H. (Toowong, Qld) requests that we discuss electric soldering irons, pistols and pencils in the "Answer Tom" section.

A: Thanks for the suggestion. We may have an opportunity to make use of it as soon as the present series on valves is finished.

A.K.C. (Eastwood, NSW) asks if he can use more than nine volts high tension with the one valve receiver described as No. 5 of the "Teach Yourself Radio" series.

A: With this set, there is no standing bias on the 3S4 and no means of limiting the plate current so that 9 volts is about the maximum plate voltage that can safely be applied. In your case the best plan would be to buy a new nine volt battery. If the two nine volt batteries you have are not capable of supplying the high tension current when connected in parallel, there will be little extra receiving time gained by connecting them in series.

C.N. (Bankstown, NSW) asks if it is possible to use a pickup with the three valve "Teach Yourself Radio" receiver described in the February 1953 issue.

A: Yes, C.N., the pickup could be connected across the 1.0 meg volume control. It would be a simple matter to arrange a switch to disconnect the .02 mfd condenser and at the same time connect a lead from the "live" pickup terminal to the top of the volume control. Most pickups will require a load resistance lower than 1.0 meg. The best way to allow for this is to connect a resistance permanently across the pickup terminals. If the pickup requires a load of .5 meg, for example, a 1.0 meg resistor connected permanently across the pickup terminals would give the required result.

J.E.H. (Salem, South India) makes some comments on the problems of deaf people and forward the circuit of an arrangement which he uses to feed a pair of headphones from a receiver.

A: Thanks indeed for your letter and we were very interested to note your comments. There is nothing new in the actual circuit you are using but it is worthwhile to note that it was satisfactory in your case.

F.C. (Oakleigh, Vic) is troubled with a receiver which "sounds like someone with a cold speaking." The symptoms only occur between two and six o'clock on Saturday afternoons.

A: Possibly the fault is connected with the temperature of components under the chassis and Saturday afternoon is the only time the receiver is left on long enough for the temperature to reach the critical point. A careful check here would be worthwhile. We suggest that you very carefully test, or better still replace, the coupling condenser between the plate of the audio voltage amplifier and the grid of the output valve. The valve itself could be suspect. Without further knowledge of the receiver it is difficult to make other suggestions.

J.H. (Christchurch, NZ) draws our attention to an article on the application of negative feedback to pickups.

A: Many thanks J.H. We agree that this is an interesting subject. So far, it is simply one of the things that we have not had the time to investigate. We will keep the matter in mind and give it our attention as soon as possible.

D.H. (Box Hill, Vic) expresses his appreciation on the contents of the magazine and would like to see a series of articles, similar to "Teach Yourself Radio," on an AC operated receiver.

A: Many thanks for your letter, D.H., but we must point out that such a collection of articles on an AC receiver was published a short time ago in the "Learn While You Build it" series, previous to a similar series on multimeters. However, you may be able to borrow the particular issues from your friends, in which case, the copies of R & H that you will need to procure are from March to December, 1951 inclusive.

N.B. (Cottesloe, WA) asks for data on a coil to tune 265 Kc with a receiver similar to the 1953 "Little Jim."

A: Sorry, N.B., but we have never had occasion to design such a coil. About all we can suggest is that you may be able to make use of an old 175 Kc IF transformer winding. The parallel condenser and perhaps some of the turns may have to be removed and some experiment would be necessary to determine suitable aerial and reaction windings.

R.G.W. (Enoggera, N.W.L., Qld) wants to know if there is any likehood of damage to the headphones with the one valve set in the "Teach Yourself Radio" series No. 4 in the November, 1952 issue.

A: No, R.G.W., you need have no worry about damage to the headphones with that set you mention because the 3S4 plate current passing through the headphones is very low. Furthermore, there is no risk of even a mild shock from the headphones as their potential with respect to earth is also very low.

A.H. (Christchurch, NZ) writes in appreciation of the Playmaster series and the control heads for use with them. He suggests that we describe some control heads, using potentiometers in place of switches in order to give continuously variable control. He also suggests switching an RF stage ahead of the wide band tuner in order to use it for distant listening when required.

A: Thanks very much for your letter and comments A.H. We are actually developing something along these lines at the moment. Many enthusiasts seem to prefer the switched controls in order that the amount of compensation provided may be exactly known and to ensure that the system may be always reset to a given response. There is some doubt whether the addition of an RF stage would produce a tuner having the characteristics you require. The Wide Range Tuner No. 2 (July, 1953) was a very successful attempt to combine the two characteristcs in the one tuner and we suggest that this might satisfy your requirements. It might be possible to switch an RF stage ahead of this tuner but the switching may prove more difficult than is justified.

H.H.J. (Auburn, NSW) writes for advice regarding an old tuner he is trying to repair.

A: We are afraid it would be impossible to advise you on this matter from the information you are able to supply. It does seem fairly likely that new electrolytic capacitors are required in the power supply but more than this we cannot say. We suggest that an experienced serviceman would be the best person to advise you on the matter.

J.P. (Potts Point, NSW) sends us a circuit from an American magazine, apparently of a battery operated tape recorder amplifier, and which he would like redesigned to use available parts.

A: Sorry J.P., but this is the kind of query we cannot handle, as it would require far too much time which must be devoted to editorial work. The extact nature of our query service is set out in the panel on these pages and we must adhere to the restrictions laid down in it. If we didn't we would never have time to publish the magazine.

C.B. (Moss Vale, NSW) asks if chemicals to make a hygroscopic earth are available and also if a 13 plate or 15 plate midget variable condenser could be used instead of the 14 plate condenser specified for the sets in the "Teach Yourself Radio" series.

A: We cannot recollect having seen advertisements for the chemicals you mention, however, it may be worth your while to write to one of the chemical supply firms. Provided the plates are about the same size as the plates of the condenser in our original receiver, either the 13 or the 15 plate variable condenser would be suitable for the regenerative receiver. Glad to know you like Radio and Hobbies.

B.W. (Horotiu, NZ) encloses a query for the Answer Tom page and asks about using a 6in disposals cathode ray tube type VCR97 in place of the 5BP1 in the Radio and Hobbies oscilloscope.

A. Many thanks for the query which has been passed on to the author of the articles. We have not had the opportunity to check the VCR97 in our oscilloscope, but it would probably be worth while your doing so. As far as we know the VCR97 is fitted with a 12-contact base and the connections from 1 to 1 are grid, cathode, heater, heater, anode 1, anode 2, internal coating, Y2, X2, anode 3, X1 and Y1.

THE "RADIO & HOBBIES" QUERY SERVICE

ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to others readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

A 2-WAY RADIO FOR BUSH FIRES

(Continued from Page 67)

tems such as 25 mfd electrolytics ntil the last.

All resistors in the receiver should e half-watt, and there are some very mall types now available. The screen nd cathode bypasses were wired vith Metalmites, to mention a brand ame for once, because these are erhaps the easiest of all to fit in.

It's a good thing with tight wiring o slip fine spaghetti over tuned coper leads rather than make short ections from plastic flex. Inevitably ne covering melts and makes a mess.

Standard tag strips are a bit large or today's requirements. We made ome of our own from slips of bakete with small holes drilled to take ne pigtails.

The wiring of the transmitter, nodulator and pre-amplifier are all ut in the open, and should be easy.

Note that a plug is mounted on the nain chassis so that the connection rom the power supply is made via a ocket. This avoids a chance of hock from handling an accidentally ve connection from the supply.

The crystal switch is mounted on small metal bracket close to the ockets, and an extension shaft runs hrough to the front.

The transmitter coil was wound on n RCS former with the pins removed nd bolted to the chassis. To find pots for the taps, first wind on the ire, and then scratch across the namel with a scriber in a diagonal ashion to locate the taps. Now unind the wire, bare the insulation at ne scratch points, and solder the ires for the taps. When the coil is rewound, there will be the tapping wires, offset so that each does not foul its neighbor.

We give here details of the coils now in the set which allow for crystal control of both receiver and transmitter. Next month we will give a second set of value specifically for frequencies at the 2 Mc end of the band to allow more favorable LC ratios and somewhat better efficiency. These original coils, however, work quite well.

The receiver crystal is chosen 455 Kc higher in frequency than the received signal. Thus, if your frequency is 5000 Kc, the right crystal frequency to use would be 5455 Kc. When aligning the set, the IF cones are adjusted for maximmu signal or noise level. The exact crystal frequency isn't critical to a few Kc, as the IF's can generally accommodate small difference from the optimum 455 Kc.

COIL DATA

Transmitter Tank Coil

26 turns of No. 19 B & S enam. wire (or similar) spaced 1⅞" on 1½" diam former, tapped at ½, 1, 2, 3, 4, 6, 8, 10, 12, 15 and 18 turns. If lathe is available, it is easiest to wind the coil in a screw thread cut at 14 turns per inch.

Receiver Aerial Coil

Primary: 8 turns of No. 28 B. & S. enam. wire closewound 1/16 in. from AVC. end of secondary. Secondary: 28 turns of No. 24 B. & S enam closewound ½" in diameter.

Receiver RF Coil

Primary: 16 turns of No. 28 B. & S enam. wire closewound over AVC end of secondary insulated with one thin paper layer. Secondary: 28 turns of No. 24 B. & S enam. closewound ½" in diameter.

Low Tension RF Choke

28 turns of 14 gauge wire closewound on 3/8 inch diam. self supporting.

If a tuning gang is used, it is adjusted also for loudest signal or noise, and final alignment made with the trimmers.

This procedure is followed because the crystal controlled oscillator is the fixed quantity, and all other circuits are lined up to it. Actually it is an easier process than with a tunable oscillator.

The receiver crystal could be 455 Kc lower than the signal — 4545 Kc in our example, which might be more convenient at the high end of the band.

The transmitter will load into almost any length of wire by selecting a tap which results in a loaded plate current of about 40-45 mills with the tank condenser tuned to resonance using a single valve, and about double that figure for two valves. If too high a tap is used, the transmitter will not modulate properly, and if too low, output will not be maximum.

If the transmitter should modulate too heavily, the grid resistor of the modulator may be split to form a potentiometer and the coupling condenser from the 6AU6 connected to the junction.

This will form what is really a fixed volume control. It should not be necessary to "tap" the condenser more than half-way down the .25 megs used in the grid circuit. In any case,

(Continued on Page 112)

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★ NOISE LEVEL
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Full & Half Track.

Pre-aligned for easy installation, you just screw them to your deck, and the tape is guided by the precision machined slot in the annealed iron case. You may record and play back with separate heads without loss of high frequency response.

★ It's the exclusive "high-low" windings (patent pending) which make possible the higher output (up to eight times that of other makes) and wider frequency range, with lower distortion and noise level. And remember—all heads are GUARANTEED to comply with the published specifications.

Technical Specifications of Head Type HL2T:—
Record-Playback combined: Half Track. (All figures for Tape Speed 7½in per second.)

Low Impedance windings:—5 ohms at 1000 c.p.s. Used principally for bias. Audio may also be applied, if desired.
High Impedance windings:—40,000 ohms at 1000 c.p.s. Used for audio. All windings astatically wound.

Output:—Approximately 10mV, with low distortion at 1000 c.p.s (will vary with individual tapes).

Gap Width:— .0003in. Hard rolled copper alloy spacer maintains sharp, clean gap. Gap width unaltered by pole wear. Gap accurately aligned with base, and tape slot.

Frequency Range:—20 c.p.s to 11,000 c.p.s (with equalisation). All heads tested with a standard tape for response and gap alignment within the following limits:—

Up to 8,000 c.p.s .. .. **plus or minus 1db.**
11,000 c.p.s. .. .. **plus or minus 3db.**
The Case:—Heavy wall section reduces hum pickup by 20db.

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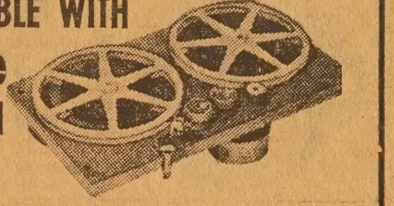

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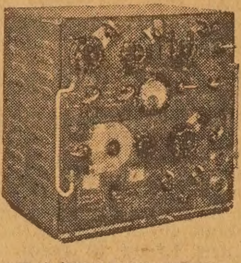

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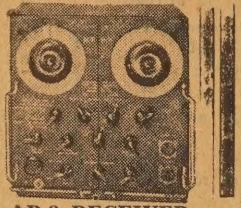

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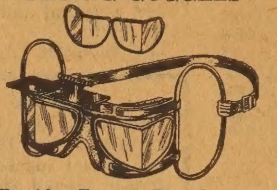

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VR150/30	22/6
954	7/11
955	7/11
12A6	12/6

2050 . . . . 22/6

This Valve is suitable for use with Photo Cell Relay Unit, as per June, 1953, issue of Radio and Hobbies.

LET'S BUY AN ARGUMENT

(Continued from Page 73)

They point out that ball races are
ised freely in high class sound pro-
ectors and tape recorders, seemingly
vithout rumble trouble; that a bump
olid enough to ruin a race would
e more than enough to demolish
he complete outfit, amplifier, cabinet
nd everything else!

Oiling! Well, anyone who has
nough resource to build a complete
ape deck (we are talking about
ome builders) can surely be trusted
vith prudent use of an oil can.

Ball races minimise friction loss,
ney point out, making that much
nore power available for the prime
ob. They last longer and are worth
ne extra initial cost.

So it goes on, a mixture of mech-
nical "theory", mechanical "prac-
ce", personal prejudice and a good
eal of influence by secondary
actors.

Without being able to speak from
lot of experience in the field, it is
bvious enough that much will de-
end on the races themselves.
pecially selected and imported types
re likely to be a lot better than
cally made ones costing but a frac-
on of the price.

CHEAP RACES

I should add "through normal
nannels". A couple of weeks ago
picked up a disposals oddment con-
ining two good races for a few
ence. Plenty of others may have
one the same.

Did Mr. Thomas use local races or
nported ones? At the time of writ-
g I don't know. And what has
een the experience of other con-
ructors in this field?

Then there's the matter of fric-
onal loss. With a powerful drive
otor it wouldn't matter anyway,
it it does matter in a marginal case.
remember well my own experience
ith the gramo. tape adaptor de-
ribed some time back.

In the case in point, Mr. Thomas
ould not have any power to spare,
ing the small BSR type motor.
ncidentally, I think the 4-pole FP10
otor was the one intended and in-
rred by the outline.) It could
sily be that a marginal difference
friction loss would be significant
the end result.

But, of course, Mr. Thomas has
ected to use the original rubber
ler from the gramo. motor, run-
ng on a reduced diameter section
the flywheel. This would give
ore freedom for the flywheel and
pstan over a straight edge-drive,
it it does involve an extra spindle
th its attendant losses.

ANCELS OUT

So he has sacrificed in one direc-
n what he gained in another.

Another correspondent suggests
at the rotational speed of the fly-
neel is too low for positive free-
m from flutter. The apparent in-
ence is that, even though Mr.
omas by accident or design gained
od results, others may not be so
tunate.

Then, again, they might! It's a
rd world.

Looking briefly at the other letters, I am indebted to J.O.R. for his comments on the English scene and his reaction to local conditions. It is always interesting to get the other point of view.

It's not so long ago, however, since the supply position locally was no less confused. I can well remember organising 50-cycle sets for local use and 40-cycle for the west. There was a consistent call for DC receivers, AC-DC sets for areas undergoing a change, plus a sprinkling of 110-volt AC, 80-volt DC, and, of course, 32-volt DC.

The position is apparently a lot better now, thank goodness.

I'm not so sure, however, about the need for all the primary tappings. While they might appear to be desirable at first glance, my impression is that our local mains would easily wander within the limits of 210 and 250 under adverse load conditions. The sets still work.

Of course, if the English mains merely start off from these nominal voltages, goodness only knows where they will end up. So much for that.

I thought the matter of the meter scale had been forgotten after everyone had enjoyed a laugh at my expense. (I likewise enjoyed my last laugh immensely.)

However, one reader was far more worried about the ohms range, which I frankly didn't even give a second thought. The explanation, however, is quite simple.

OHMS CIRCUIT

The usual ohms circuit in a multimeter puts a 1.5 volt cell and a 1500 (partially variable) resistor in series with the meter. When the test prods are shorted, it naturally reads full scale.

Placing an external resistor of 1500 ohms between the prods raises the total circuit resistance to 3000 ohms, so that the meter reads half scale. Therefore, the 1500 ohm point in the resistance range corresponds very closely with 0.5 milliamp. On the other ohms ranges, the shunts are deliberately "wangled" to keep the half-scale readings as multiples of 15.

This particular meter has been calibrated for a slightly modified ohms measuring circuit. It still uses a 1.5 volt cell, but the series resistance is made less than 1500 ohms and the meter is set to zero by a variable shunt resistor. Purpose of this scheme is to make the readings rather less dependant on the condition of the battery.

With values commonly employed, the half-scale reading corresponds to about 1100 ohms. Other ranges are similarly arranged to occur as multiples of 11 rather than 15.

Where zero ohms corresponds with zero current, an entirely different arrangement is used. Switching the meter to "ohms" causes it to read full scale. The unknown resistor is then connected in parallel with the meter circuit, causing it to read less than full scale. Zero ohms naturally corresponds to a short across the meter and no reading.

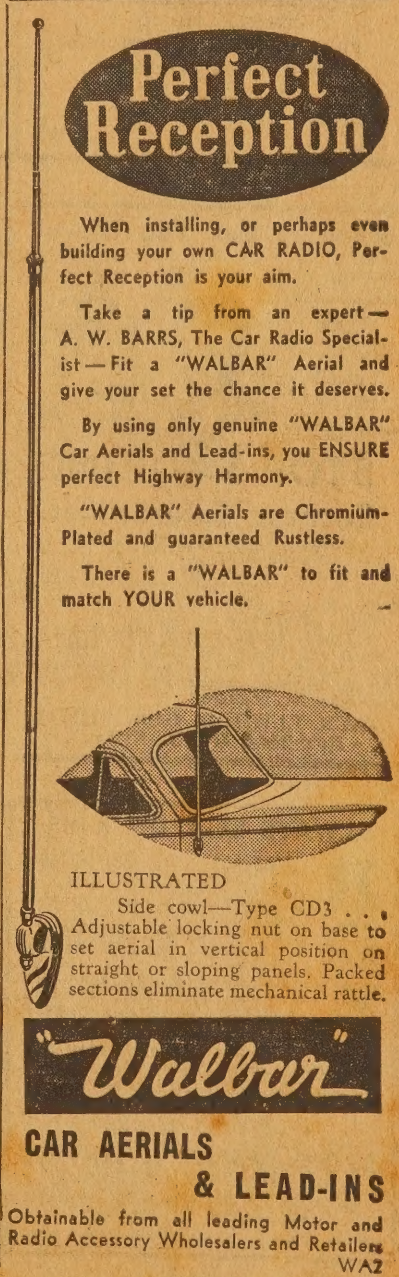
Radioactive hazards

(Continued from Page 19)

Loosely held, coarse, particulate matter can be removed quantitatively by suction. Finely divided particles, or material ground into a surface, may be only partially removed by suction.

Concrete (painted and unpainted) and wood (unpainted) were decontaminated by heating the surface with an oxyacetylene descaling torch, followed by scraping and vacuum cleaning. This removed paint and a thin surface layer of the concrete or wood flooring. The surfaces were completely restored by repainting and the decontamination was complete.

The radioactive waste, principally carpets, linoleum, and cleaning rags, filled more than two hundred drums. The drums were weighted with concrete and sunk at sea in water deeper than 100 fathoms.



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FOR SALE: Frequency dividing transformers and key contact resistance material for electronic organ, also keys and pedal board. **6 Strathearn Av., Coburg, Vic.**

FOR SALE: Sell 1196 transceiver complete no xtals. Fully modified, in good condition. Suit yacht or cruiser. £35. **XW8117, Sydney.**

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SALE: Tape recorder—Prof. (15w PP), wide range tuner, mark II, 150 in vent., 18in transcription turntable, mike, tapes, etc. Offer. **Reply c/- Box 8104, R & H.**

SELL: Diagnomoscope, Paton electric modulated oscillator, also precision meter. **10 Station St., Auburn, Vic.**

SELL: Kodak Retinette Camera. Bought new, July, 1952. As new. Will pack in wooden box, £18. **R. Sims, Lakes Entrance, Vic.**

SELL: English portable signal tracer, multimeter and signal generator built in one, as new. Only £40. **XB2589. After hours, XL1649.**

SELL: CRO 3in type MD/32 separat
power supply. Good, £25. **L. Mash
man, 12 Halley Av., Bexley. LX5981.**

SELL: National HRO receiver, 29 mcs
100 kcs, S meter, BFO Signal gener
ator. Highest offers. Valve Teste
wanted. **Thompson, 128 Albert St., Eas
Melbourne.**

SELL: BC348 with OP stage and LS
240 AC, £35. Command TX, BC459A
complete, £5. Command RX 12v conv. t
BC car radio, complete, £11. Another
£9½. Palec-minor multimeter, perf., £
Following surplus gear, what offers? An
relay unit BC442A, 28v dynamotor. Tubes
81, 100TH, 800, 807, 813, 865, 866A, 162
Transformers AWA 665v a side at 500 mA
Various heavy duty fils. trans., trans
mitter power chokes, res. bridge an
galvo. Must go. **O'Brien, 181 Barkly St
Nth., Fitzroy, Vic. JW1897.**

SELL: MN26 Bendix Comm. Receive
Conv. 240AC. New valves, Speake
£22. **Write 43 Westbrook St., Beverly Hill**

SELL: Tape deck with erase, twin trac
record playback heads. Also specia
engraved front and top panels for tap
recorder amplifier, £25. **23 Bourke St
Richmond, NSW.**

SELL: BC348R, 240 AC, near new, £2
S. C. Cox, Huskisson, NSW.

SELL: TRX 101, 1st class, complete
power supply, etc., £15. Comm. Rcv
No. 4 Philips, as new 1650 kc-20M, 6v an
240 AC pwr. supply. Spare panel vibra
tor, 1st class, £20. Converter, 50VDC t
240 AC, filtered at 100w. As new. £1
G. Edwards Merimbula.

WANTED: 150 to 200 watt amplifier o
mod. or parts 1250v tranny valve
2—866, 2—811, output tranny. AWA 5f
horns. **126 Buckingham St., Sydney
MX3121.**

WANTED: Nov. '52, R. & H. good orde
Will pay 5/-. **E. Kershaw, Yea, V.**

WANTED: Good rcv. AR8 or similar
with pwr. supply and 12in spkr. Sell
3BZ ty. or swap for rcv., also 1 hp eng
and gen. 110v rectif. PK. AC to DC, 115v
M. J. O'Brien, Dockyard, via Maitland.

WANTED: Instruction manual, contro
box and cables for ARB receive
Also 23-pin plug and cables, 15 pin plu
and cables for MN26 receiver. **Camp
bell, Box 42, PO, Sorrento, Vic.**

WANTED URGENTLY: Mine detecto
or circuit diagram. **M. C. Mayo, 3A
Roseberry St., Auburn, Vic.**

RADIO FOR BUSHFIRES

(Continued from Page 109)

the nature of the circuit makes splattering virtually impossible, and over modulation will do little more than cause distortion.

In the circuit a 7500-ohm resistor is included to increase the current drain of the set when receiving. This was done becauce the high current rating of the power supply will produce too high a receiver voltage unless steps are taken to reduce it. This bleed resistor is the simplest method, but a series resistor plus an extra 8 mfds bypass would be just as effective. It is important that this resistor is not included for mobile work. Here the voltages automatically adjust themselves for both receive and transmit.

The equipment has been air-tested using the amateur bands, and has done all we could ask of it. It is quite simple to handle, and once the setting of the various controls is found, they require no further adjustment in the field.

In next month's issue we will give full details of both whip and wire aerials for use with the equipment, together with further hints which will undoubtedly come up during experiments.

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